



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EDISON, NEW JERSEY 08837

November 2, 1988

250053



MEMORANDUM:

SUBJECT: Bossert "PCB" Cleanup, Utica, New York

FROM: Michael F. Solecki, Atmospheric/Marine Physical Scientist
NOAA Liaison, Environmental Response Branch

TO: John Witkowski, On-Site Coordinator
EPA Region II

THRU: Royal J. Nadeau, Chief
Environmental Impact Section

John D. Nadeau

As per the information given to us at our meeting of October 28, 1988, the following has been established:

After investigating all of the possibilities, it has been determined that the vapors associated with the breakdown of polychlorinated biphenyls (PCB's) will not be a problem, under extreme fire conditions, at this particular site. It has been our experience that, the products of combustion of PCB fluids, when associated with ash and soot producing combustible materials (such as wood, oil, and some plastics), tend to adsorb to the solid particulates given off during a fire situation (e.g., see EPA/ERT Report on Swissvale Auto Surplus Parts, Swissvale, Pennsylvania). Attached are Tables from that report showing on-site soot composition and off-site findings from wipe samples. The breakdown products of the PCB's then adsorb to those particulates and are carried off as smoke. Since current atmospheric emission models such as TRACE, CHARM, ALOHA, etc., are not designed for particulates, their use is inappropriate in this instance.

It is my opinion, as a Fire Protection Engineer with 18 years experience, it is the particulates that are the problem, not the vapors. Steps should be taken to reduce the possibility of the particulates being released from the building. This can be accomplished by removing the material and properly disposing of it. The other option is to leave it in place and lessen the risk of incineration. This can be accomplished by evaluating the "Fireload" (the expected maximum of combustible material in a given area), and designing either an automatic detection and extinguishing system, a proper fire and smoke rated enclosure, or both.

If you desire, we are willing to help you establish the level of protection required. Please feel free to call us if you have any questions.

Attachment

DRAFT

MEMO DRAFT

TO: JACK HARMON
EPA/

FROM: DENISE JOHNSON
ATSDR/ REGION II

SUBJECT: HEALTH CONSULTATION
BOSSERT MANUFACTURING, UTICA, NEW YORK

THE ENVIRONMENTAL PROTECTION AGENCY (EPA) ASKED THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR) TO EVALUATE THE HEALTH EFFECTS THAT WOULD OCCUR IN THE EVENT OF A FIRE AT THE BOSSERT MANUFACTURING FACILITY, BOTH FOR NEARBY RESIDENTS AND FOR FIREFIGHTERS.

REVIEW OF THE INFORMATION PROVIDED TO ATSDR SHOWED THAT THE AVERAGE PCB CONCENTRATION WAS APPROXIMATELY 50 PARTS PER MILLION (PPM). THE TOXIC SUBSTANCES CONTROL ACT (TOSCA) PERMITS UNRESTRICTED BURNING OF ^{it} CONTAINING UP TO 50 PPM PCB'S. THE LOW LEVELS OF PCB'S FOUND AT THIS SITE WOULD NOT POSE A HEALTH THREAT TO EITHER THE RESIDENTS OR FIREFIGHTERS. HOWEVER, SMALL AMOUNTS OF HYDROCHLORIC ACID MAY BE FORMED AND COULD EFFECT ANYONE DIRECTLY INHALING THE FUMES. IT SHOULD BE NOTED THAT THE POTENTIAL FOR THE PRODUCTION OF DIOXINS AND FURANS EXISTS.

QUESTIONS REGARDING THIS HEALTH CONSULTATION SHOULD BE DIRECTED TO DENISE JOHNSON OR BILL NELSON AT 201-321-6657 OR 212-264-7662.

11/21/88 9:15 AM
talked to Jack about this -
he will ✓ with Utica perps
and let us know whether
anything else is needed.
DJ

Analyzing PCBs

Basic information about PCBs and how they are identified and measured

Ann L. Alford-Stevens
Environmental Protection Agency
Cincinnati, Ohio 45268

Polychlorinated biphenyls (PCBs) were first reported in environmental samples in 1966 (1) and by 1974 were the most discussed of the organic pollutants (2). Although they may no longer have that distinction, PCBs are still a serious environmental problem, and many articles have been published about them. A recent review of the analytical chemistry of PCBs contained a bibliography of more than 1200 references (3). Most writers on the subject assume basic knowledge that is not readily available to many professionals, including lawyers, engineers, and journalists, whose work involves PCBs.

Probably the most important factor in selecting appropriate procedures for determining PCBs and in understanding analytical data is communication between knowledgeable analysts and data users. The basic information provided in this article should facilitate such discussions.

What is a PCB?

A PCB is any one of 209 compounds of the general formula $C_{12}H_xCl_y$, where $x = 0-9$ and $y = 10-x$. PCBs are produced by chlorinating the biphenyl compound, which has 10 positions (labeled 2-6 and 2'-6' in Figure 1) available for chlorine atoms. Different structural arrangements make possible 209 compounds distributed among the 10 levels of chlorination (Table 1). Although 46 PCBs contain 5 chlorines (Cl_5 PCBs), only one contains 10.

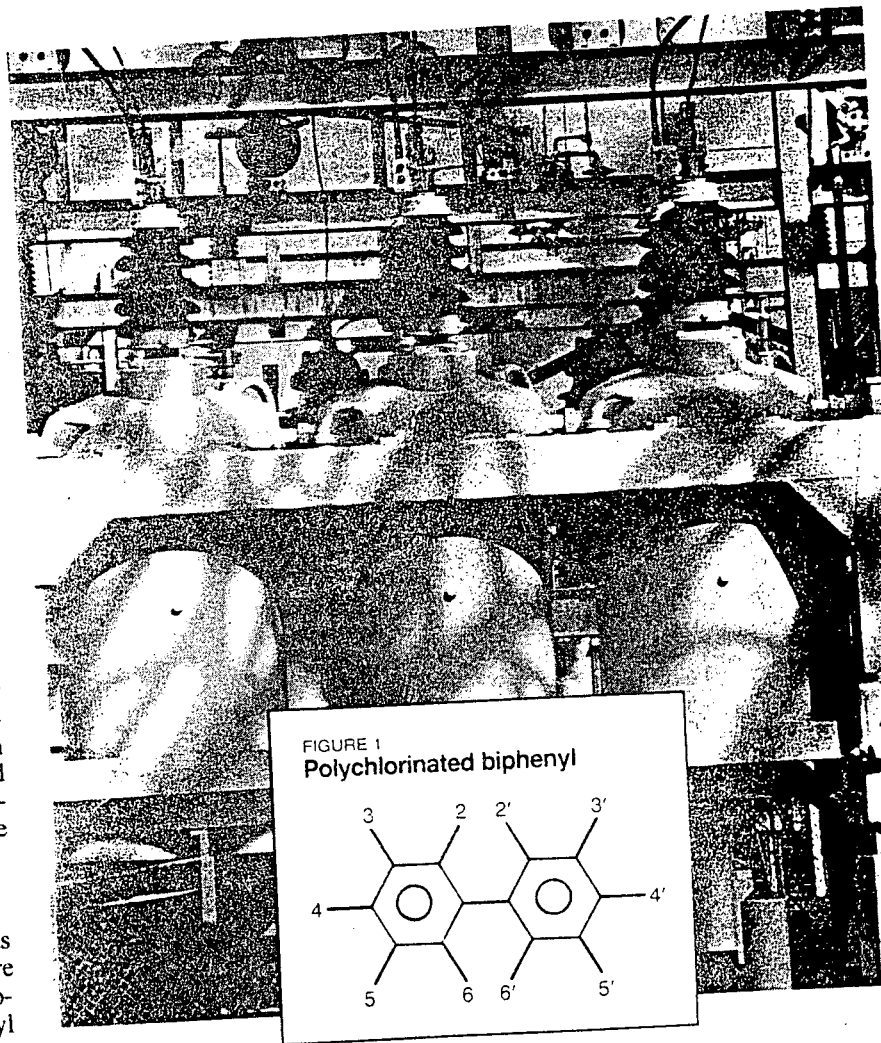
The term congener is applied to any of the 209 possible PCBs. Isomers are PCBs that have the same number of chlorine atoms but differing arrange-

ments of the chlorines on the biphenyl rings. For example, all 46 possible Cl_5 PCBs are isomers that make up an isomer group. Because chemical names include all the numbers of the chlorine positions on the two phenyl rings, such cumbersome nomenclature as 2,2',3,3',4,5,5',6,6'-nonachlorobiphenyl (Cl_9 PCB) results. Ballschmiter and Zell devised a system that assigns each

compound a number from 1 to 209 (4). This system has been adopted by the International Union of Pure and Applied Chemists; the numbers are also called IUPAC numbers.

Commercial formulations

Commercial PCBs were produced by collecting boiling-point fractions (Table 2) during distillation of chlorinated



phenyl mixtures. In the United States, the only large producer of PCBs was Monsanto Chemical Company, which sold them from 1929 to 1975 under the Aroclor trademark. Not all PCBs are Aroclors, but most Aroclors are mixtures of PCBs. The name Aroclor is frequently used interchangeably with "PCB." In fact, a few Aroclor formulations were chlorinated terphenyls or mixtures of chlorinated terphenyls and chlorinated biphenyls (2). Non-PCB Aroclors have not attracted widespread concern; virtually all attention has focused on PCB Aroclors. The term Aroclor is used in this article to refer to commercial PCB formulations.

Each Aroclor is assigned a four-digit number (Table 2). For most PCB Aroclors (such as 1242), the first two numbers indicate the 12 carbons in the biphenyl ring, and the last two numbers indicate the weight percent of chlorine. Aroclor 1016, which is similar to 1242, was not named according to the standard designation.

Not all PCBs are present in Aroclors, because some biphenyl positions are more susceptible than others to chlorination. Although 125 PCBs have been found in Aroclors (5), the number of reported components of each Aroclor varies (Table 2), depending on the type of analysis performed and the quantity analyzed.

Properties of PCBs and Aroclors

The number of chlorine atoms contained in major Aroclor components increases with increasing percentage of chlorine. For example, Aroclor 1221 is composed principally of Cl_1 PCBs, but Aroclor 1260 contains mostly Cl_5 , Cl_6 , and Cl_7 PCBs. Most PCB congeners are solids at room temperature, but Aroclor formulations are viscous fluids that are resistant to acids, bases, and heat. PCBs have low water solubility, which decreases with increasing level

Analytical problems

Appropriate analytical procedures for PCB determinations must be selected to obtain needed information, depending on the particular situation. The range of potential PCB environmental problems is illustrated by two quite different situations.

- A transformer fluid that contains Aroclor 1254, along with chlorinated (Cl_1 and Cl_2) benzenes, has been spilled, and PCB-contaminated soil must be removed and disposed of appropriately.

Here the issue is not the identification of the PCBs but the measurement of Aroclor concentrations to determine whether PCB contamination exceeds the concentration of 50 $\mu\text{g/g}$. Conventional gas chromatography-electron capture (GC-EC) determinations of PCBs as Aroclors will provide the needed information. The Cl_1 and Cl_2 benzenes will produce EC detector responses that can be distinguished from the target Aroclors by retention times.

Furthermore, calibration of detector response over a wide concentration range is not necessary. The analyst should be given this information rather than being presented with a form requesting "PCB determinations."

- After a transformer fire, an area is contaminated, and the level of contamination must be determined before cleanup begins.

Here the problem is not only with PCBs but also with combustion products which frequently include chlorinated dibenzo-p-dioxins and dibenzofurans. The information produced by a mass spectrometric detector is essential because these three classes of compounds and other potential sample components have similar GC retention times and EC detector responses. In addition, samples would not be expected to contain intact Aroclors. Furthermore, the broad range of concentrations of concern and the variety of samples (wipe samples, ash, and soil) will require extensive consultation among data requesters, samplers, analysts, and data users.

TABLE 1
Distribution of PCBs by level of chlorination

| Isomer group | Molecular formula | No. of compounds |
|---------------------------|-------------------|------------------|
| Monochlorobiphenyls | $C_{12}H_9Cl$ | 3 |
| Dichlorobiphenyls | $C_{12}H_8Cl_2$ | 12 |
| Trichlorobiphenyls | $C_{12}H_7Cl_3$ | 24 |
| Tetrachlorobiphenyls | $C_{12}H_6Cl_4$ | 42 |
| Pentachlorobiphenyls | $C_{12}H_5Cl_5$ | 46 |
| Hexachlorobiphenyls | $C_{12}H_4Cl_6$ | 42 |
| Heptachlorobiphenyls | $C_{12}H_3Cl_7$ | 24 |
| Octachlorobiphenyls | $C_{12}H_2Cl_8$ | 12 |
| Nonachlorobiphenyls | $C_{12}HCl_9$ | 3 |
| Decachlorobiphenyl | $C_{12}Cl_{10}$ | 1 |
| Total number of congeners | | 209 |

TABLE 2
Properties of Aroclors

| Property | Aroclor | | | | | | | | |
|--|---------|-----------------|-----------------|----------------------|----------------------|----------------------|----------------------|-----------------|--------------------|
| | 1221 | 1232 | 1016 | 1242 | 1248 | 1254 | 1260 | 1262 | 1268 |
| Density (lb/gal, 25 °C) | 9.85 | 10.6 | 11.4 | 11.5 | 12.0 | 12.8 | 13.5 | — | — |
| Distillation range (°C) | 275–320 | 290–325 | 323–356 | 325–366 | 340–375 | 365–390 | 385–420 | 390–425 | 435–450 |
| Viscosity (100 °F) | 38–41 | 44–51 | 71–81 | 82–92 | 185–240 | 1400–2500 | — | — | — |
| Vapor pressure (20 °C, mm Hg) | — | — | — | 9.0×10^{-4} | 8.3×10^{-4} | 1.8×10^{-4} | 0.9×10^{-4} | — | — |
| Vaporization rate ^a (mg/cm ² /h) | 1.7 | 0.87 | — | 0.34 | 0.15 | 0.053 | 0.009 | 0.013 | — |
| Principal components | Cl_1 | Cl_1 – Cl_3 | Cl_2 – Cl_4 | Cl_2 – Cl_4 | Cl_3 – Cl_5 | Cl_4 – Cl_6 | Cl_5 – Cl_7 | Cl_6 – Cl_8 | Cl_6 – Cl_{10} |
| Reported number of components | 10–25 | 16–34 | 27–49 | 27–74 | 43–63 | 27–116 | 35–124 | — | — |

^aExposure at 100 °C for 12 h; surface area 12.3 cm².
Sources: References 1, 3, and 6.

solubility of one of the Cl_1 PCBs is 5.9 mg/L but that of Cl_{10} PCB is only 0.015 mg/L (6).

Vapor pressure (volatility) and degradability also decrease with increasing chlorine content. In addition, susceptibility to degradation depends on the structural arrangement of chlorine atoms among isomers. Some PCBs are preferentially accumulated in biota, whereas others are excreted. PCBs are strongly sorbed onto sediment, clay, and soil and are transported, for example, by runoff, erosion, precipitation, and wind.

The more soluble and volatile congeners are transported preferentially, and PCBs are now found in remote areas where Aroclors have never been used. These variable characteristics indicate why environmental samples frequently contain PCBs that are quite different from Aroclor formulations.

PCBs in the environment

During the 45 years that PCBs were in production and use, they were disseminated throughout the world. The very characteristics that made Aroclors desirable commercial products cause the persistent problems with PCBs. Originally, they were used as coolants and dielectric fluids in transformers and capacitors, as heat transfer fluids, and as coatings to reduce the flammability of wood products. Later, PCBs were incorporated into paints, inks, dust control agents, carbonless paper, and pesticides.

In 1976, Congress banned the manufacture, processing, distribution, and use of PCBs except in totally enclosed systems (electrical transformers, capacitors, and electromagnets). Since then, various regulations have attempted to control further distribution of PCBs, including those that are incidentally generated along with some desired product.

By 1978, U.S. landfills had accumulated 140×10^6 kg, and an additional 8.25×10^7 kg of PCBs and Aroclors had been introduced into the environment in forms available for transport, transformation, or accumulation (6). PCBs are still being used in 2.8 million capacitors and some 150,000 transformers. Some of these fail each year and release additional quantities into the environment (7).

Analytical procedures

Understanding results of PCB and Aroclor determinations requires some basic knowledge of the analytical procedures used to acquire the data. The basic elements of all PCB and Aroclor determinations are as follows:

- removal (extraction) of the com-

- portion of interest from the sample matrix into one that can be analyzed,
- enrichment of the concentration relative to that of other sample components,
- separation of extracted components, and
- identification and measurement of the compounds of concern.

The first two items, which depend on the nature of the sample (for example, soil vs. biota), were reviewed recently (3); they are beyond the scope of this article. The third and fourth areas, separation and identification and measurement, are its focus.

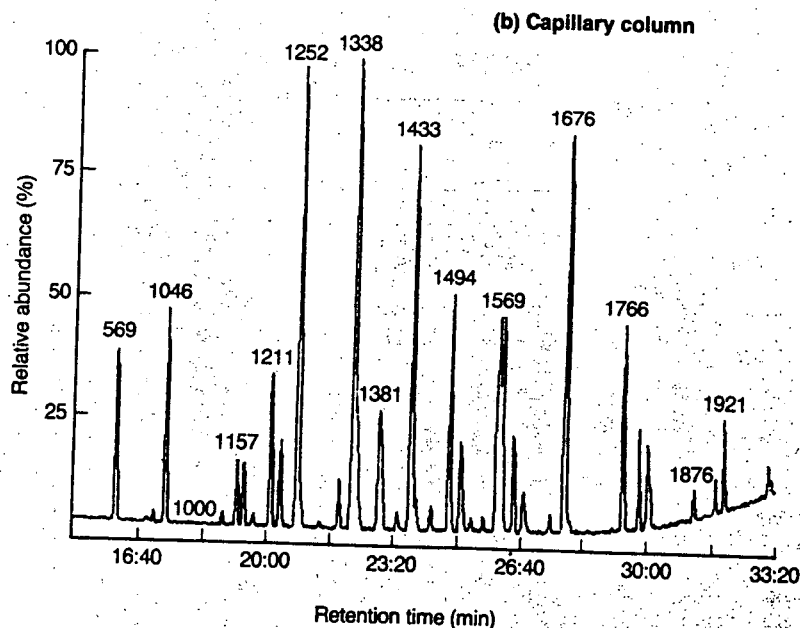
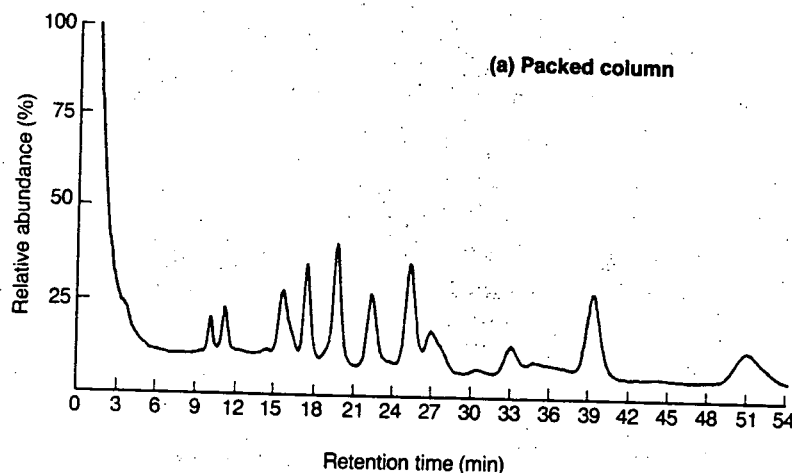
Separation. Sample components are separated by gas chromatography (GC). The separation device is a GC column, which is a glass tube installed in an oven. After injection of a few microliters of a sample extract into the

GC column, vaporized components move through the column with the carrier gas.

Components are separated because they travel at different rates depending on their affinities for the stationary liquid phase and the mobile gas phase. As sample components exit the GC column, they are observed as peaks on a graph (called a chromatogram) of relative abundance vs. time.

Gas chromatography columns are either low resolution (packed) or high resolution (capillary). A packed column is a glass tube (2–3 m \times 0.7 cm i.d.) filled with an inert material that is coated with a liquid stationary phase. A capillary column is a glass tube (25–60 m \times 0.25–0.5 mm i.d.) coated with a thin film of a liquid stationary phase. Capillary columns are widely used because they provide better separation of

FIGURE 2
GC separation of Aroclor 1260



sample components than packed columns do.

The difference between separations obtained in packed and capillary columns can be demonstrated by chromatograms of Aroclor 1260 (Figure 2). The time required for a PCB to travel through a GC column (retention time) can be correlated with the level of chlorination, because retention times tend to increase with increasing chlorine content. This correlation is only approximate, however, because PCB retention times also vary with the structural arrangement of their chlorine atoms. For example, 3,3',4,4'-Cl₄ PCB may be retained longer than any other Cl₄ PCB and even longer than some Cl₆ PCBs (8).

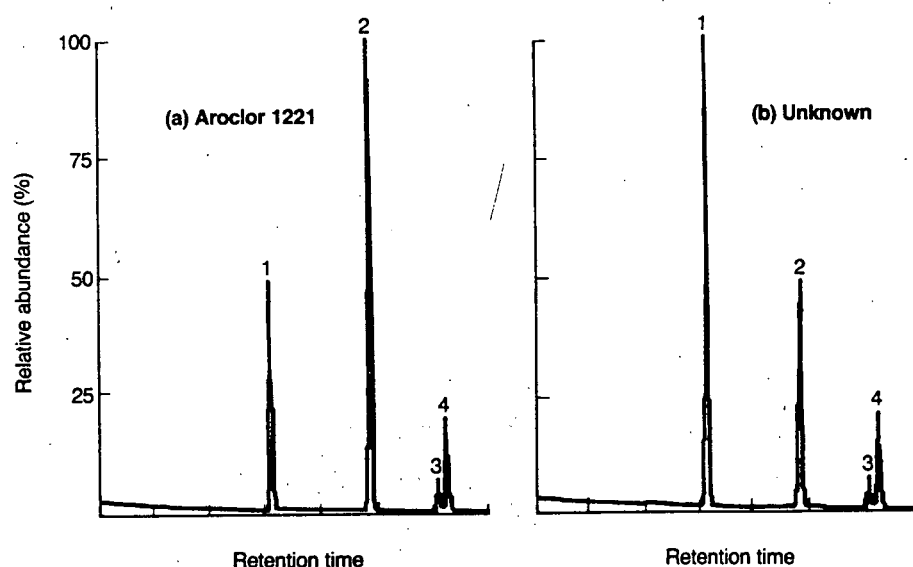
Identification and measurement. Sample components must be detected and measured as they elute from the GC column. Detectors can provide information about chemical structure or may give only general information about some chemical characteristic of the sample. Most PCB determinations are performed either by mass spectrometry (MS) or with an electron capture (EC) detector.

EC detectors. During the past two decades, most PCB determinations have involved the use of EC detectors to identify and measure PCBs in terms of Aroclors. The EC detector responds to any chlorinated or brominated compound, but it does not provide additional information about compound structure. It cannot distinguish between chlorinated or brominated compounds, and it does not provide information about the number of chlorine or bromine atoms present.

As sample components pass through the EC detector, electronegative compounds absorb (capture) electrons to produce a proportional decrease in base line electrical current, which is recorded continuously. The analyst must rely on appearance of a detector signal (peak) at the appropriate retention time to identify a sample component. The retention time must be determined by analyzing a standard of the compound of interest under the same conditions used to analyze the sample.

Unfortunately, another sample component to which the EC detector responds might have the same retention time as a PCB. Although all 209 PCBs have been synthesized (8), only about 90 are available commercially for use in laboratories that perform PCB determinations. Therefore, Aroclors have been used to determine when PCBs should appear in a sample chromatogram. Although Aroclors vary somewhat in composition from one batch to another and the samples frequently do not contain intact Aroclors, no alterna-

FIGURE 3
Comparison of Aroclor 1221 with an unknown



tive standards are available.

In using EC detectors to identify Aroclors, analysts rely on comparison of a chromatogram of a standard with that produced by a sample. In each case, analysts must judge whether the samples and Aroclor chromatograms are sufficiently similar, because acceptable differences have not been defined. This problem of pattern recognition is illustrated by comparison of chromatograms for Aroclor 1221 and an unknown (Figure 3). If all four peaks appear in the sample chromatogram (Figure 3b) at the same retention times and relative abundances as in the Aroclor 1221 chromatogram (Figure 3a), the pattern is easily recognized. If, however, their relative abundances are not equivalent, one identification criterion is not met. The absence of one of the peaks would make the identification of the sample component as Aroclor 1221 questionable. Most samples that contain PCBs produce far more complex patterns than the ones shown in Figure 3.

After identification of the Aroclor, concentrations of the components must be measured. In general, EC detector response to PCBs increases with increasing level of chlorination, but it also varies among isomers. Measured GC areas (or heights) of peaks produced by sample components must be related to those produced by Aroclor standards.

The most widely used Aroclor measurement procedure was developed in 1973 by Webb and McCall (9). They determined the weight percent of the major components of each GC peak observed from packed-column separation

of Aroclors. This calibration procedure cannot be used with capillary columns. The Webb-McCall procedure involves measuring every sample component peak corresponding to an Aroclor peak, but analysts frequently select only a few GC peaks and relate measured peak heights or areas in samples to those in Aroclor standards.

The choice of the particular peaks measured can be a significant source of data variability. For example, if the height of peak 1 in Figure 3b is compared with Aroclor 1221 (Figure 3a), the reported sample concentration is twice that of the standard. If the height of peak 2 is selected, however, the reported concentration is half that of the standard.

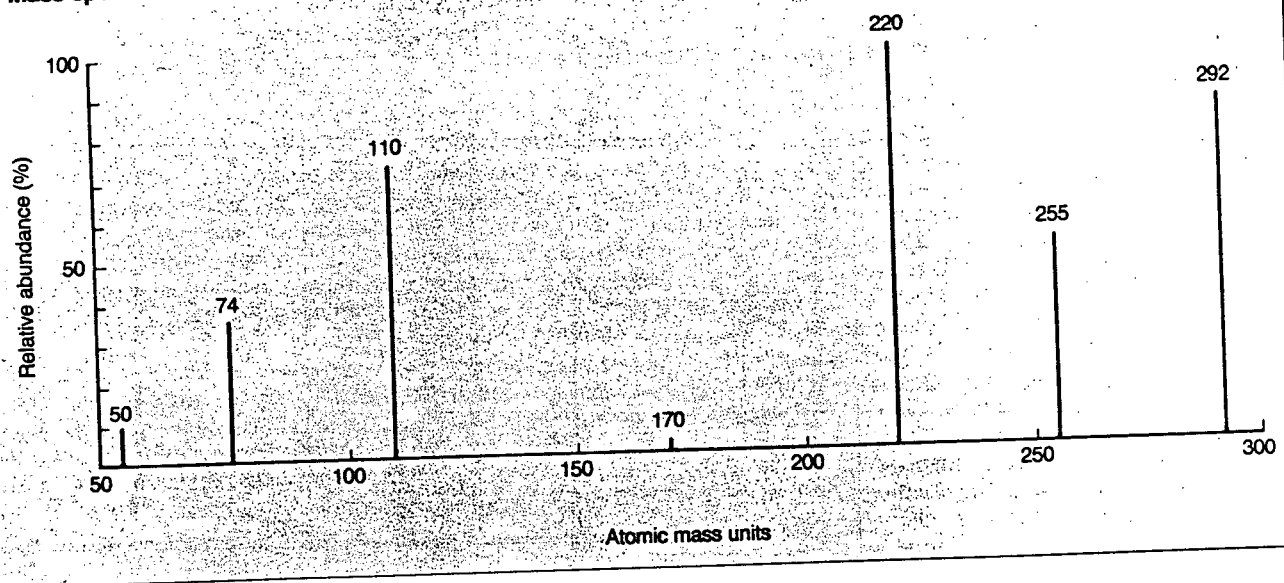
The data user must understand the phrase "reported as Aroclor x." It means that the analyst thought the sample chromatogram more closely resembled Aroclor x than any other Aroclor, and the reported concentration was based on an Aroclor x standard.

When a sample contains a degraded Aroclor or a mixture of Aroclors, opportunities for qualitative and quantitative error increase substantially. Although some analysts can identify an Aroclor or mixture of Aroclors by a brief examination of a sample chromatogram, many cannot.

MS determination. In addition to all of the information obtained with an EC detector, a mass spectrometer provides the molecular weight and the number of chlorine atoms in a PCB. This information significantly increases the likelihood that the component has been correctly identified.

A brief discussion of how electron

FIGURE 4
Mass spectrum of a tetrachlorobiphenyl



impact (EI) mass spectra are produced should facilitate an understanding of the data obtained. When sample components exit a GC column and enter a mass spectrometer, they are bombarded with electrons and lose electrons and atoms to form positive ions. When one electron is lost, the resulting ion (the molecular ion) has essentially the same mass as the original molecule. When the molecule loses an atom or groups of atoms, fragment ions are formed. With PCBs, molecular and fragment ions alike are formed.

In MS, the ions are subjected to conditions that cause them to travel through the mass analyzer at different rates, depending on the mass-to-charge ratio (m/z). A mass spectrum is produced by detecting and measuring the relative abundance of each m/z as a function of time. The characteristic features of a mass spectrum, such as that for a Cl_4 PCB (Figure 4), are among the data used to identify a PCB.

As sample components exit a gas chromatograph and enter a mass spectrometer, the molecules that are fragmented continually change. Therefore, rapid, frequent measurement of mass spectra is necessary, and a computer is needed to control the instrument and to receive and store data. With PCBs, the mass range of interest is usually about 45–520 atomic mass units (amu).

The computer is programmed to control MS operation to scan the mass range (about 475 amu) in 1 s or less. Therefore, only about 2 ms is spent acquiring data for each mass unit. Mass spectra are acquired repetitively and numbered sequentially from the beginning of data acquisition to its end. Information about the mass and relative abundance of each detected ion in each

spectrum is stored, and all information acquired for a particular sample composes a data file.

A plot of the sum of the abundances of all ions in all spectra vs. spectrum number for each spectrum in a data file shows a total ion current profile (TICP). A TICP is similar to a chromatogram and is sometimes called a mass chromatogram or a reconstructed gas chromatogram. (The chromatogram in Figure 2b is a TICP).

Each sample component mass spectrum can be displayed by selecting an appropriate spectrum number and plotting mass vs. relative intensity. The data can be manipulated to enhance a spectrum when sample components are not completely separated or to eliminate ions produced from column coating materials and residual air. Using the TICP, the analyst can select an appropriate background spectrum and instruct the computer to subtract it from the spectrum of a sample component.

These actions can be illustrated with the GC peak labeled 1433 (which is actually a mass spectrum number) in Figure 2b. When this peak was expanded with computer software (Figure 5), two peaks (apex at 1433 and 1440) could be seen. Each dot shows where a scan (acquisition of a mass spectrum) ended, ion abundances were summed to produce a point on the TICP plot, and another scan began (at m/z 45). When that scan ends at m/z 520, measured ion abundances are added to produce the next point, and the points are connected to produce the TICP.

In this example, the mass spectrometer scanned from m/z 45 to m/z 520 18 times (spectra 1427–1444) while the two peaks were eluting. Spectrum 1433 could be selected to indicate the charac-

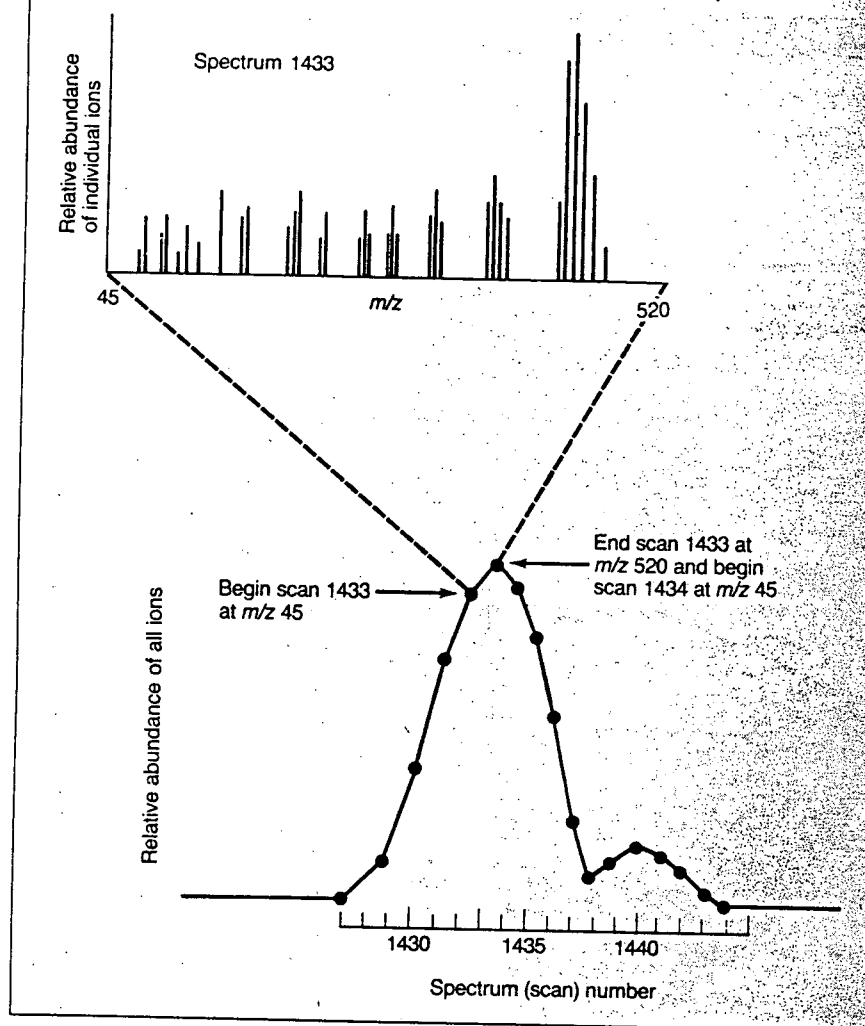
teristics of the components producing one peak, and 1440 could show the other. Spectra 1437 and 1438 probably contain ions characteristic of both components. Therefore, spectrum 1437 or spectrum 1438 could be subtracted from 1433 to obtain one that does not contain ions produced only by the sample components represented by the peak that has its apex at 1440.

Because chlorine isotopes of mass 35 and mass 37 exist in known relative abundance in nature, the measured abundance of ions that contain chlorine in molecular ion isotope clusters indicates the level of chlorination of each detected PCB. PCBs that contain the same number of chlorine atoms produce very similar mass spectra. For example, all Cl_4 PCBs produce ions of known relative abundance in a cluster from m/z 290 to m/z 298, with major ions spaced 2 amu apart (Figure 4). Therefore, although mass spectra cannot be used to distinguish isomers, this spectral similarity allows identification of PCBs by level of chlorination.

Even with identification of PCBs by level of chlorination, measurement of PCB concentrations in samples that contain a variety of these compounds is a problem. A relatively recent approach to the problem of MS detector calibration is to use one PCB at each level of chlorination to represent all members of that isomer group (3, 10). Because the response varies from one isomer to the next, this approach produces results with an inherent error. This error is minimized by using a compound that produces a response near the mean response for all available members of the isomer group. A concentration for each isomer group is calculated, and a total PCB concentration is obtained by sum-

FIGURE 5

Repetitive acquisition of mass spectra produces a total ion profile



ming up the isomer group concentrations. One major advantage of this approach is that it is applicable to all samples that contain PCBs, whether they are intact Aroclors, degraded Aroclors, preferentially bioaccumulated congeners, or PCBs produced incidentally during some manufacturing or treatment process.

Although specific compounds are not identified with this approach, information about individual sample components is not lost. The number of PCBs identified in each sample can be reported, and a concentration can be estimated for each, if desired. In addition, measured retention times of identified PCBs can provide information about the probable presence or absence of specific PCBs because retention times for all 209 congeners have been published (8). The data user must remember, however, that retention times do not provide absolute identification.

Identification and measurement

Specific PCBs can be identified and measured by use of capillary column GC and standards for all 209 conge-

ners. Although no one GC column has been found to separate all 209 PCBs well enough to produce discrete peaks, a single capillary column has been used to separate 187 congeners (8). To achieve maximum GC resolution, analysis times of 140–200 min are used.

Tentative identification based on relative retention time can be confirmed or refuted by introducing a pure standard of each candidate compound along with the sample extract aliquot. This approach is useful for seeking one or a few individual compounds but is not practical for routine monitoring for all possible PCBs.

Automated interpretation

Many analytical instruments incorporate computers to control operations and process data, and efforts to take advantage of their data-handling, interpretation, and computational abilities are continually expanding. Chemometrics, the application of computerized multivariate statistical methods to pattern recognition, is a rapidly expanding field that eliminates reliance on an individual's recognition of GC peak pro-

files to identify PCB sample components as specific Aroclors (5).

Other specialized software provides automated interpretation of mass spectra to identify and measure PCBs by level of chlorination (11). It evaluates sample component spectra by emulating human data interpretation and computational logic. A concentration is automatically calculated for each isomer group, and a total PCB concentration is calculated by summing isomer group concentrations. Undoubtedly, automated data interpretation will be applied increasingly in the future as new software becomes widely available and as analysts become more familiar with its operation.

Acknowledgment

This article has not been subjected to review by EPA. Therefore, it does not necessarily reflect the views of the agency, and no official endorsement should be inferred.

This article has been reviewed for suitability as an *ES&T* feature by Lawrence Keith, Radian Corporation, Austin, Tex. 78766.

References

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Ann L. Alford-Stevens is a research chemist in the Physical and Chemical Methods Branch of EPA's Environmental Monitoring and Support Laboratory. She manages research projects to develop and demonstrate analytical methods for the identification and measurement of organic chemical pollutants.

Finally . . . Superfund



Richard M. Dowd

After nearly two years of conflict and debate, Congress has passed and President Ronald Reagan has signed the Superfund Amendments and Reauthorization Act of 1986. The statute contains four titles. Titles 1 and 2 rewrite the original Superfund law, the Comprehensive Environmental Response, Compensation and Liability Act of 1980.

The financing portions of the bill will, over its five-year lifetime, raise \$8.5 billion from a general manufacturing tax, specific levies on chemical and petroleum products, and a tap on general treasury funds. These monies will be used to pay for cleaning up abandoned hazardous waste sites for which the responsible parties cannot be found and assessed for the costs. In addition, the bill finances a new Leaking Underground Storage Tank Trust Fund by levying a new tax of 0.1¢/gal on all types of motor fuels.

The new Title 3 contains emergency planning and community right-to-know provisions that require communities to gather and publish information on hazardous substances that can affect them either through accidental releases or through routine emissions of hazardous materials. EPA must publish an acute-hazards list naming 400 of these substances within 30 days.

The agency must also begin drawing up rules establishing a threshold planning quantity (TPQ) for each substance on the acute-hazards list. If EPA does not establish TPQs, the new law will automatically set the quantity at 2 lb for each substance. If a TPQ for a hazard-

ous substance exists at a facility, the facility is subject to Superfund's emergency planning requirements.

Finally, Title 4 establishes a radon gas and indoor air quality research program.

Other highlights

Superfund requires a total reevaluation of the existing Hazardous Ranking System (HRS) that determines whether a site is to be placed on the National Priority List (NPL) of facilities that require cleanup.

Tight timetables are set for EPA to begin remedial investigation/feasibility studies for some 650 sites within five years, and EPA is directed to clean sites at a pace much more rapid than the previous rate of fewer than a dozen over the past five years. The bill also authorizes EPA to provide technical assistance grants of up to \$50,000 per site to assist participation by the general public in decisions involving cleanups.

The new law authorizes potentially responsible parties (PRPs)—entities that are liable, as contributors of wastes to specific abandoned sites—to carry out their own remedial investigation and feasibility studies and to take action to clean up sites. In these cases, the government would supervise qualified contractors paid by the PRPs.

Superfund explicitly authorizes EPA to negotiate settlements with those responsible for a hazardous waste site, and the bill establishes procedures to encourage settlements instead of lengthy, costly law suits.

The new law gives special relief from non-negligent liability to contractors who carry out cleanup activities. The inability of many firms to obtain liability insurance in the market has hindered recent cleanup projects.

Addressing the "how clean is clean?" issue, the law specifies criteria for EPA to use in determining appropriate cleanup levels. These standards are to take effect 30 days after enactment and require, as a minimum, that cleanups meet any legally applicable federal,

state, or local standard, criterion, or limitation. In many cases, the most stringent standards would be the Safe Drinking Water Act's maximum contaminant level goals, which are set at zero for carcinogens. All cleanups are required to be done as cost-effectively as possible.

An initial \$50 million is provided for the agency to fund the Toxic Substance and Disease Registry (ATSDR)—an independent arm of the Department of Health and Human Services, which will conduct health research at sites as deemed necessary by the ATSDR administrator. By mid-April 1987, ATSDR and EPA are to prepare a list of the 100 substances most commonly found at Superfund sites; an additional 100 substances are to be added within 24 months. Each listing must be accompanied by a summary of the substance's characteristics, toxicity, and known health effects.

Superfund explicitly establishes programs for research, development, demonstration, and training to encourage alternative and innovative treatment technologies and to improve detection and assessment of effects and risks regarding human health.

The law requires that each state certify, within three years, that it has sufficient disposal capacity to handle all hazardous wastes generated within its borders for the next 20 years. Without that assurance, Superfund monies will be withheld from any noncomplying state except in certain emergency cases.

Superfund will drive EPA's work agenda for some time to come. These highlights are only a sample of the bill's major provisions; others will be discussed in future columns.

Richard M. Dowd, Ph.D., is a Washington, D.C., consultant to Environmental Research & Technology, Inc.

HSN - 55
 NAME - CHLOROBENZENE
 RN - 108-90-7
 COFO - COLORLESS LIQUID [MERCK INDEX. 10TH ED 1983 , p. 2981 **PEER REVIEWED**
 ODOR - FAINT, NOT UNPLEASANT ODOR [MERCK INDEX. 10TH ED 1983 , p. 2981 **PEER REVIEWED**
 ODOR - ALMOND-LIKE ODOR [SAX. HAWLEY'S CONDENSED CHEM. DICT. 11TH ED. 1987 , p. 2631 **PEER REVIEWED**
 ODOR - Mild amine odor [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 ODOR - Mild aromatic [SITTIG. HANDBOOK TOXIC HAZARD CHEM. & CARCINOGEN. 2 ED. 85 , p. 2251 **PEER REVIEWED**
 TAST - ND
 BP - 132 DEG C @ 760 MM HG [WEAST. HDBK CHEM. & PHYS. 67TH ED. 1986-87 C-1091 **PEER REVIEWED**
 MP - -45.6 DEG C [WEAST. HDBK CHEM. & PHYS. 67TH ED. 1986-87 C-1091 **PEER REVIEWED**
 MW - 112.56 [MERCK INDEX. 10TH ED 1983 , p. 2981 **PEER REVIEWED**
 CORR - Liquid chlorobenzene will attack some forms of plastics, rubber, and coatings [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 CTP - Critical temperature: 578 deg D= 359 deg C= 632 K; critical pressure: 44.6 atm [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 DEN - 1.1058 @ 20 DEG C/4 DEG C [WEAST. HDBK CHEM. & PHYS. 67TH ED. 1986-87 C-1091 **PEER REVIEWED**
 DSC - ND
 HTC - 6,700 cal/g or 280x10⁵ J/kg [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 HTV - 75 cal/g or 3.14x10⁵ J/kg [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 OWPC - log Kow= 2.18-2.84 [HANSCH. SUBST. CONST. CORR. ANAL. CHEM./BIOLOGY. 1979 , p. 1971 **PEER REVIEWED**
 PH - ND
 SOL - SOL IN ALCOHOL, ETHER, BENZENE [WEAST. HDBK CHEM. & PHYS. 67TH ED. 1986-87 C-1091 **PEER REVIEWED**
 SOL - 448 ppm in water [Kenaga EE; Ecotox Environ Safety 4: 26-38 (1980)1 **PEER REVIEWED**
 SOL - Miscible with nearly all organic solvents [ITI. TOX & HAZARD INDUS. CHEM. SAFETY MANUAL 1982 , p. 1201 **PEER REVIEWED**
 SPEC - INDEX OF REFRACTION: 1.5241 @ 20 DEG C/D [WEAST. HDBK CHEM. & PHYS. 67TH ED. 1986-87 C-1091 **PEER REVIEWED**
 SPEC - MAX ABSORPTION (ALCOHOL): 245 NM (LOG E= 1.95); 251 NM (LOG E= 2.34); 258 NM (LOG E= 2.13); 264 NM (LOG E= 2.45) [WEAST. HDBK CHEM. & PHYS. 60TH ED. 1979 C-1531 **PEER REVIEWED**
 SPEC - MAX ABSORPTION (ALC): 272 NM (LOG E= 2.32); Sadtler Reference Number: 34 (IR, PRISM); 19 (IR, GRATING); 16 (UV); 714 (NMR) [WEAST. HDBK CHEM. & PHYS. 60TH ED. 1979 C-1531 **PEER REVIEWED**
 SURF - 33 dynes/cm at 25 deg C [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 VAPD - 3.88 [ENCYC. OCCUPAT. HEALTH & SAFETY 1983 , p. 4591 **PEER REVIEWED**
 VAP - 11.8 mm Hg at 25 deg C [PATTY. INDUS. HYG. & TOX. 3RD ED. VOL. 2A, 2B, 2C 1981-82 , p. 36041 **PEER REVIEWED**
 EVAP - 1 (Butyl acetate= 1) [NIOSH OSHA. OCCUPAT. HEALTH GUIDE CHEM. HAZARDS. 1981 , p. 21 **PEER REVIEWED**
 VISC - 0.790 cp at 70 deg F [CHRIS. HAZARD CHEM. DATA VOL. II 1984-5 1 **PEER REVIEWED**
 OCPP - VERY REFRACTIVE LIQ. [MERCK INDEX. 10TH ED. 1983 , p. 2981 **PEER REVIEWED**
 OCPR - PER CENT IN SATURATED AIR: 1.55 (25 DEG C); DENSITY OF SATURATED AIR:

- EVAP - EPA 440/5-80-0681 Evaporation loss at 100 deg C for 6 hours is 0-0.1%.
[USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-14 (1987) EPA ECAO-CIN-414] **PEER REVIEWED**
- VISC - At 54.4 deg C: 3200-4500 Saybolt sec at 98.9 deg C: 72-78 Saybolt sec.
[USEPA; Environmental Assessment of PCBs in the Atmosphere p.2-7 (1976) MTR-72101] **PEER REVIEWED**
- OCPP - Distillation range: 385-420 deg C. [USEPA; Ambient Water Quality Criteria Doc: Polychlorinated Biphenyls p.A-6 (1980) EPA 440/5-80-0681] **PEER REVIEWED**
- OCPP - With the exception of Aroclors 1221 and 1268, Aroclors do not crystallize upon heating or cooling, but at a specific temperature, defined as a "pour point", change into a resinous state. The pour point of Aroclor 1260 is 31 deg C. /From Table/. [USEPA; Ambient Water Quality Criteria Doc: Polychlorinated Biphenyls p.A-6 (1980) EPA 440/5-80-0681] **PEER REVIEWED**
- OCPP - Since an Aroclor is a variable mixture, literature Kow values will vary. These increase with increasing chlorination. Low Kow= i values at 25 deg C: 3.76 (biphenyl), 5.7 (C14-PCB's), 6.0 (C15-PCB's), 7.0 (C16-PCB's), 8.26 (C110-PCB's). /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16 (1987) ECAO-CIN-414] **PEER REVIEWED**
- OCPP - The most water soluble PCBs (least chlorinated) are enriched in water relative to the original aroclor. /Polychlorinated biphenyls/ [Hutzinger O et al; The Chemistry of PCB's p.16 (1974)] **PEER REVIEWED**
- OCPP - Solubility in water varies because aroclors are variable mixtures. /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16 (1987) ECAO-CIN-414] **PEER REVIEWED**
- OCPP - Variable since aroclors are variable mixtures; the most highly volatile PCBs (high vapor pressure) will predominate, so that the PCB composition of the vapor will be enriched in the least chlorinated PCB's. /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-15,16 (1987) ECAO-CIN-414] **PEER REVIEWED**
- OCPP - Aroclor 1260 when pyrolysed in the gas phase for 2 seconds at 500-700 deg C formed tri- to hepta-chlorinated dibenzofurans to form at approximately 2% yield: 2,3,7,8-TCDF and 1,2,3,7,8- and 2,3,4,7,8-polychlorinated dibenzofuran dominated. [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-23,24 (1987) EPA ECAO-CIN-414] **PEER REVIEWED**
- OCPP - Cl content: 60%; Max acidity: 0.014 mg koh/g; max moisture: 50 ppm. [Hutzinger O et al; The Chemistry of PCB's p.10-11 (1974)] **PEER REVIEWED**
- OCPP - Polychlorinated biphenyls /including Aroclor 1260/ in transformer oil react with polyethylene-glycols and potassium hydroxide. [Brunelle DJ et al; Environ Sci Technol 19(8): 740-6 (1985)] **PEER REVIEWED**

HSN - 6357

NAME - AROCLOR 1254

RN - 11097-69-1

COFO - Light yellow, viscous liquid [MERCK INDEX. 10TH ED 1983 , p. 1031] **PEER REVIEWED**

ODOR - PRACTICALLY ODORLESS [CHRIS. HAZARD CHEM DATA VOL. II 1984-5] **PEER REVIEWED**

TAST - ND

BP - Distillation range 365-390 deg C [MERCK INDEX. 10TH ED 1983 , p. 1031] **PEER REVIEWED**

MP - ND

MW - Average mol wt: 327 [USEPA; Environmental Assessment of PCBs in the Atmosphere p.2-6 (1976) MTR-72101] **PEER REVIEWED**

CORR - ND

CTP - ND

DEN - 1.495-1.505 at 65 deg C/15.5 deg C. [Hutzinger O et al; The Chemistry of PCB's p.10 (1974)] **PEER REVIEWED**

DSC - ND

HTC - ND

1.05 (AIR=1) IPATTY. INDUS HYG & TOX 3RD ED VOL2A,2B,2C 1981-82 , p.

38041 **PEER REVIEWED**

OCPP - EQUIVALENCIES IN AIR : 1 MG/L = 217 PPM AND 1 PPM = 4.80 MG/CU M @ 25 DEG C, 760 MM HG IPATTY. INDUS HYG & TOX 3RD ED VOL2A,2B,2C 1981-82 , p.

38041 **PEER REVIEWED**

OCPP - Heat of fusion: 20.40 cal/g ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1
PEER REVIEWED

OCPP - Saturated liquid density= 69.080 lb/cu ft @ 70 deg C ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

OCPP - Liquid heat capacity= 0.321 Btu/lb-F @ 70 deg C ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

OCPP - Liquid thermal conductivity= 0.869 Btu-in/hr-sq ft-F at 70 deg C ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

OCPP - Saturated vapor pressure= 0.195 lb/sq in @ 70 deg C ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

OCPP - Ideal gas heat capacity= 0.207 Btu/lb ft @ 75 deg C ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

OCPP - [Sato A, Nakajima T; Scand J Work Environ Health 13: 81-93 (1987)]
Partition coefficients at 37 deg C for chlorobenzene into blood = 30.8;
into oil = 3,760. **PEER REVIEWED**

HSN - 1822

NAME - AROCLOR 1260

RN - 11096-82-5

COFO - Light yellow, soft, sticky resin IMERCK INDEX. 10TH ED 1983 , p. 10911
PEER REVIEWED

ODOR - Practically odorless ICHRIS. HAZARD CHEM DATA VOL. II 1984-5 1 **PEER REVIEWED**

TAST - ND

BP - ND

MP - ND

MW - Average mol wt: 372. [USEPA; Environmental Assessment of PCBs in the Atmosphere p.2-7 (1976) NTR-72101 **PEER REVIEWED**

CORR - ND

CTP - ND

DEN - 1.58 at 25 deg C [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-10 (1987) EPA ECAO-CIN-4141 **PEER REVIEWED**

DSC - ND

HTC - ND

HTV - ND

OWPC - log Kow= 6.11 ICALLAHAN. WATER-REL ENVIRON FATE PRIORITY POLLUT VOL I, 1979 36-41 **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

USER:

yes

PH - ND

SOL - 0.080 ml/l @ 24 deg C IVERSCHUEREN.HDBK ENVIRON DATA ORG CHEM 1983 , p. 2211 **PEER REVIEWED**

SOL - Average water solubility at 25 deg C= 0.027 mg/l [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-14 (1987) EPA ECAO-CIN-4141 **PEER REVIEWED**

SPEC - Refractive index at 20 deg C= 1.647-1.649. [Hutzinger O et al; The Chemistry of PCB's p.11 (1974)] **PEER REVIEWED**

SPEC - The spectrum for each aroclor is very complex being a superposition of the spectra for the individual constituents. UV spectral maximums are at 197-222, 214-265, and 267-302 nm, and give strong molecular ions in mass spectra infrared absorption wavelengths are 1200-300/cm. [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16,17 (1987) ECAO-CIN-4141 **PEER REVIEWED**

SURF - ND

VAPD - ND

VAP - EPA 440/5-80-0681 4.05x10-5 mm Hg at 25 deg C [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-14 (1987) EPA ECAO-CIN-4141 **PEER REVIEWED**

HTV - ND
 OWPC - log Kow= 6.30 (est) [Kenaga EE, Goring CAI; Aquatic Toxicology p.78-115 (1980)] **PEER REVIEWED**
 PH - ND
 SOL - IN WATER: AROCLOR 1254, 70 PPB [GRIFFIN RA, CHIAN ES K; US ENVIRON PROT AGENCY, OFF RES DEV, (REP); EPA-600/2-80-027; 101 (1980)] **PEER REVIEWED**
 SOL - Water solubility at 25 deg C= 12 ug/l. [USEPA; Ambient Water Quality Criteria Doc: Polychlorinated Biphenyls p.A-6 (1980) EPA 440/5-80-068] **PEER REVIEWED**
 SOL - In water: 0.01 ppm. [Kenaga EE, Goring CAI; Aquatic Toxicology p.78-115 (1980)] **PEER REVIEWED**
 SPEC - Refractive index at 20 deg C= 1.639-1.641. [USEPA; Environmental Assessment of PCBs in the Atmosphere p.2-7 (1976) MTR-7210] **PEER REVIEWED**
 CONTINUE PRINTING? (YES/NO)
 USER:
 yes
 SPEC - The spectrum for each aroclor is very complex being a superposition of the spectra for the individual constituents. UV spectral maximums are at 197-222, 214-265, and 267-302 nm, and give strong molecular ions in mass spectra. Infrared absorption wavelengths are 1200-300/cm. [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16,17 (1987) ECAO-CIN-414] **PEER REVIEWED**
 SURF - ND
 VAPD - ND
 VAP - Average vapor pressure is 7.7×10^{-5} mm Hg at 25 deg C. [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-14 (1987) EPA ECAO-CIN-414] **PEER REVIEWED**
 EVAP - Evaporation loss at 100 deg C/6 hr= 0-0.2%. [Hutzinger O et al; The Chemistry of PCB's p.10 (1974)] **PEER REVIEWED**
 VISC - 1800-2500 Saybolt sec at 37.8 deg C; 260-340 Saybolt sec at 37.8 deg C; 44-48 Saybolt sec at 98.9 deg C [Hutzinger O et al; The Chemistry of PCB's p.11 (1974)] **PEER REVIEWED**
 OCPP - Solubility in water is extremely low; soluble in oils and organic solvents /Polychlorinated biphenyls/ [IARC MONOGRAPHS. 1972-PRESENT V18 49 (1978)] **PEER REVIEWED**
 OCPP - With the exception of Aroclors 1221 and 1268, Aroclors do not crystallize upon heating or cooling, but at a specific temperature, defined as a "pour point", change into a resinous state. The "pour point" for Aroclor 1254 is 10 deg C. /From table/ [USEPA; Ambient Water Quality Criteria Doc: Polychlorinated Biphenyls p.A-3-6 (1980) EPA 440/5-80-068] **PEER REVIEWED**
 OCPP - Since an Aroclor is a variable mixture, literature Kow values will vary. These increase with increasing chlorination. Low Kow values at 25 deg C: 3.76 (biphenyl), 5.7 (C14-PCB's), 6.0 (C15-PCB's), 7.0 (C16-PCB's), 8.26 (C110-PCB's). /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16 (1987) ECAO-CIN-414] **PEER REVIEWED**
 OCPP - The most water soluble PCBs (least chlorinated) are enriched in water relative to the original aroclor. /Polychlorinated Biphenyls/ [Hutzinger O et al; The Chemistry of PCB's p.16 (1974)] **PEER REVIEWED**
 OCPP - Solubility in water varies because aroclors are variable mixtures. /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-16 (1987) ECAO-CIN-414] **PEER REVIEWED**
 OCPP - Variable since aroclors are variable mixtures; the most highly volatile PCBs (high vapor pressure) will predominate, so that the PCB composition of the vapor will be enriched in the least chlorinated PCB's. /Polychlorinated biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-15,16 (1987) ECAO-CIN-414] **PEER REVIEWED**
 OCPP - Cl content: 54%; Maximum acidity: 0.010 mg koh/g; Maximum moisture: 50 ppm [Hutzinger O et al; The Chemistry of PCB's p.10,11 (1974)] **PEER REVIEWED**

OCPP - Pyrolysis of Aroclor 1254 in the gasphase at 2 sec 500-700 deg C formed mostly mono- to penta-chlorinated dibenzofurans with a yield of approx 2%, including 1,3,4,7,9-penta-chlorinated dibenzofuran, chlorinated phenols and chlorinated naphthalenes. [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCB's) p.II-21 (1987) EPA ECAO-CIN-414] **PEER REVIEWED**

SS 3 /C?

USER:

prt exsr

SEARCH IN PROGRESS...

NP (PRT EXSR)

*NONE-

SS 3 /C?

USER:

prt exsr

HSN - SS

NAME - CHLORO BENZENE

RN - 108-90-7

IDLH - 2400 ppm [NIOSH. NIOSH POCKET GUIDE CHEM HAZ 5TH PRT 1985 , p. 761 **QC REVIEWED**

ADI - 1.008 mg/day [USEPA; Ambient Water Quality Criteria Doc: Chlorobenzene p.C-20 (1980) EPA 440/5-80-0281 **QC REVIEWED**

ATOL - ND

OSHA - Meets criteria for OSHA medical records rule. [29 CFR 1910.20 (7/1/87)] **PEER REVIEWED**

OSHA - 8-hr Time-Weighted avg: 75 ppm (350 mg/cu m) [29 CFR 1910.1000 (7/1/87)] **PEER REVIEWED**

NREC - ND

TLV - Time-Weighted Avg (TWA) 75 ppm, 350 mg/cu m (1987-88) [ACGIH. TLVs 1987-88 , p. 15] **QC REVIEWED**

TLV - Excursion Limit Recommendation: Short-term exposures should exceed three times the TLV-TWA for no more than a total of 30 min during a work day and under no circumstances should they exceed five times the TLV-TWA, provided that the TLV-TWA is not exceeded. [ACGIH. TLVs 1987-88 , p. 6] **QC REVIEWED**

OOPL - SUBTLE CHANGES OBSERVED IN RATS AT 75 & 250 PPM SUGGEST THAT CURRENT MAX PERMISSIBLE CONCN OF 75 PPM MAY BE TOO HIGH & THAT 5 TO 10 PPM MAY BE BETTER WORKING LEVEL. [DILLEY JV; US NTIS, PB REP; PB-276623, 80 (1977)] **PEER REVIEWED**

WSTD - Toxic pollutant designated pursuant to section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. [40 CFR 401.15 (7/1/87)] **PEER REVIEWED**

WSTD - Designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. [40 CFR 116.4 (7/1/87)] **PEER REVIEWED**

ASTD - This action promulgates standards of performance for equipment leaks of Volatile Organic Compounds (VOC) in the Synthetic Organic Chemical Manufacturing Industry (SOCMI). These standards implement Section 111 of the Clean Air Act and are based on the Administrator's determination that emissions from the SOCMI cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare. The intended effect of these standards is to require all newly constructed, modified, and reconstructed SOCMI process units to use the best demonstrated system of continuous emission reduction for equipment leaks of VOC, considering costs, non air quality health and environmental impact and energy requirements. Chlorobenzene is produced, as an intermediate or final product, by process units covered under this subpart. These standards of performance become effective upon

promulgation but apply to affected facilities for which construction or modification commenced after January 5, 1981. [40 CFR 60.483 (7/1/87)]
PEER REVIEWED

SSTD - ND

CERC - Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 100 lb or 45.4 kg. The toll free telephone number of the NRC is (800) 424-8802; in the Washington metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.6 (section IV. D.3.b). [50 FR 13456 (4/4/85)] **PEER REVIEWED**

TSCA - Section 8(a) of TSCA requires manufacturers of this chemical substance to report preliminary assessment information concerned with production, use, and exposure to EPA. [40 CFR 712.30 (7/1/87)] **PEER REVIEWED**

TSCA - Pursuant to section 8(d) of TSCA, EPA promulgated a model Health and Safety Data Reporting Rule. The section 8(d) model rule requires manufacturers, importers, and processors of listed chemical substances and mixtures to submit to EPA copies and lists of unpublished health and safety studies. Chlorobenzene is included on this list. [40 CFR 716.120 (7/1/87)] **PEER REVIEWED**

RCRA - When chlorobenzene, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to federal and/or state hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may qualify for partial exclusion from hazardous waste regulations (see 40 CFR 261.5). [40 CFR 261.33 (7/1/87)] **PEER REVIEWED**

RCRA - When chlorobenzene is a spent solvent, it is classified as a hazardous waste from a nonspecific source (F002), as stated in 40 CFR 261.31, and must be managed according to state and/or federal hazardous waste regulations. [40 CFR 261.31 (7/1/87)] **PEER REVIEWED**

FIFR - ND

FDA - ND

HSN - 1822

NAME - AROCLOR 1260

RN - 11096-82-5

IDLH - ND

ADI - ND

ATOL - ND

OSHA - Meets criteria for OSHA medical records rule. [29 CFR 1910.20 (7/1/87)]
PEER REVIEWED

NREC - ND

TLV - ND

OOPL - ND

WSTD - ND

ASTD - ND

SSTD - ND

CERC - ND

TSCA - ND

RCRA - ND

FIFR - Elimination of all use as active or inactive ingredients. [EPA/OPTS. SUSPEND CANCEL RESTRICT PEST 3RD REV 1985, p. 17] **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

USER:

yes

FDA - ND

HSN - 6357

NAME - AROCLOR 1254

RN - 11097-69-1

IDLH - NIOSH has recommended that chlorodiphenyl containing 54% chlorine be

treated as a potential human carcinogen. /Chlorodiphenyl (54% chlorine)/
NIOSH. NIOSH POCKET GUIDE CHEM HAZ 5TH PRT 1985 , p. 781 **UNREVIEWED**

ADI - ND
ATOL - ND
OSHA - Meets criteria for OSHA medical records rule. [29 CFR 1910.20 (7/1/87)]
PEER REVIEWED
NREC - ND
TLV - Time Weighted Avg (TWA) 0.5 mg/cu m, skin; Short Term Exposure Limit
(STEL) 2 mg/cu m, skin (1987-88) [ACGIH. TLVs 1987-88 , p. 15]
UNREVIEWED
OOPL - ND
WSTD - ND
ASTD - ND
SSTD - ND
CERC - ND
TSCA - ND
RCRA - ND
FIFR - Elimination of all use as active or inactive ingredients. [EPA/OPTS.
SUSPEND CANCEL RESTRICT PEST 3RD REV 1985 , p. 17] **PEER REVIEWED**
FDA - ND
SS 3 /C?
USER:
prt toxh

HSN - SS
NAME - CHLOROBENZENE
RN - 108-90-7
TOXS - ND
TXHR - ND
PPOT - TOXIC BY INHALATION, SKIN CONTACT, OR INGESTION. ALSO AN EYE IRRITANT.
INPPA. FIRE PROTECT GUIDE HAZARD MATLS 5TH ED 1986 49-29] **PEER
REVIEWED**
PPOT - THE TOXIC EFFECTS OF CHLOROBENZENE SEEM TO BE PRIMARILY LIVER AND KIDNEY
INJURY. THE HEMATOPOIETIC EFFECT OF THE PARENT HYDROCARBON (BENZENE)
APPEARS TO BE ABSENT. [ACGIH. DOCUMENTATION OF TLVS 5TH ED 1986 , p. 123]
PEER REVIEWED
ANTR - ND
MEDS - Consider the points of attack /respiratory system, eyes, skin, CNS,
liver/ in preplacement and periodic physical examination [SITTIG.
HANDBOOK TOXIC HAZARD CHEM & CARCINOGEN 2 ED 85 , p. 226] **PEER REVIEWED**
HTOX - CHLOROBENZENE IS HEMOLYTIC. /FROM TABLE/ [ARENA. POISONING 5TH ED. 1986 ;
p. 25] **PEER REVIEWED**
HTOX - SLIGHT SKIN IRRITATION MAY OCCUR FROM APPLICATION OF MONOCHLOROBENZENE ON
SKIN. REPEATED CONTACT ... MAY RESULT IN MODERATE ERYTHEMA & SLIGHT
SUPERFICIAL NECROSIS. [ENCYC OCCUPAT HEALTH & SAFETY 1971 , p. 291]
PEER REVIEWED
HTOX - An elderly female exposed to a glue (containing 0.07% chlorobenzene) for
a period of six years, had symptoms of headache, irritation of the eyes
and upper respiratory tract, and was diagnosed ... /as having/ ...
medullary aphasia. Three adults developed numbness, loss of
consciousness, hyperemia of the conjunctiva and pharynx following exposure
to high levels of chlorobenzene. [SITTIG. HANDBK TOXIC HAZARD CHEM 1981 ,
p. 118] **PEER REVIEWED**
HTOX - IT IS A CNS DEPRESSANT. DEGENERATION OF THE LIVER & KIDNEYS HAS BEEN
OBSERVED FOLLOWING ABSORPTION OF TOXIC DOSES. THE HISTOLOGICAL CHANGES
MAY PROGRESS AS EXPOSURE BECOMES MORE SEVERE OR AS THE PERIOD OF EXPOSURE
IS LENGTHENED. LIVER INJURY MAY PROGRESS TO NECROSIS & PARENCHYMOUS
DEGENERATION. [PATTY. INDUS HYG & TOX 3RD ED VOL2A,2B,2C 1981-82 , p.
3605] **PEER REVIEWED**
HTOX - Clinical examination of workers exposed to chlorobenzene in the
manufacture of polyvinyl chloride showed that some workers suffered from
poisoning although the concentrations of chlorobenzene in the atmosphere

fication of carcinogenicity: 1) evidence in humans: limited; 2) evidence in animals: sufficient. Overall summary evaluation of carcinogenic risk to humans is Group 2A; the agent is probably carcinogenic to humans. /From table, polychlorinated biphenyls/ [IARC MONOGRAPHS. 1972-PRESENT 57 70 (1987)] **PEER REVIEWED**

PPOT - ND

ANTR - ND

MEDS - PRECAUTIONS FOR "CARCINOGENS": Whenever medical surveillance is indicated, in particular when exposure to a carcinogen has occurred, ad hoc decisions should be taken concerning ... /cytogenetic and/or other/ tests that might become useful or mandatory. /Chemical Carcinogens/ [IARC SCIENTIFIC PUBLICATIONS NO. 33 1979 , p. 23] **PEER REVIEWED**

HTOX - The effect of material exposure to polychlorinated biphenyls (PCBs) on fetal birth weight and gestational age was investigated among humans. Personnel records from PCB manufacturing facilities engaged in producing capacitors using Aroclor-1254, Aroclor-1242, and Aroclor-1016 were examined. Number of pregnancies, birth weight, maternal age, parity, year of birth, race, sex, date of last menses, and parental education data was obtained. There was a total of 388 pregnancies to 354 females and 51 births to 39 females who worked directly in the facility where PCBs were manufactured. These subjects had worked for a minimum of 1 year prior to the birth of the infant and were identified as a high exposure group. There were 337 births to 280 females who worked at locations within the facility where PCBs were not directly used; these were identified as a low exposure group. Birth weights were adjusted for gestational age. The two exposure groups were compared with matched comparisons from the general population. A 53 gram difference was seen between birth weight means of the low and high exposure groups. On the average, the highly exposed workers were older, had more parity, were less educated, and gave birth earlier in the study than the low exposure group. High exposure to PCBs was associated with reduced birth weight even after adjustment for year of birth, maternal parity, and sex of infant. This group also showed shortened gestational age after adjustment for these same variables. Mean gestational age was reduced by 66 days compared to low exposure groups. Average birth weight of low exposure groups. Average birth weight of low exposure group infants was 66 grams greater than their matched general population comparisons while that for the high exposure infants was 35 grams less than their comparisons. ... The mean birth weight difference between the low and high exposure group is the result of a shortened gestational period than a retardation of intrauterine growth. [Taylor PR et al; American Journal of Public Health 74 (10): 1153-4 (1984)] **PEER REVIEWED**

HTOX - The biochemical and hematological effects of polychlorinated biphenyls (PCB) were studied in occupationally exposed workers. The study group consisted of 194 individuals exposed to Aroclor-1016 and, in some cases, to Aroclor-1242 or Aroclor-1254 in electrical capacitor filling and sealing operations. Airborne concentrations of PCB ranged from 200 to 2,000 micrograms per cubic meter in 1975. Clinical examinations of the workers were made in 1976 and repeated in 1979, 23 months after cessation of PCB use in the factory. Data was collected from medical history, electrocardiogram, physical examination, X-ray, spirometry, a 26 parameter biochemical analysis, hematology, and urinalysis. ... There was a depression in serum bilirubin and elevations in serum gamma-glutamyl-transpeptidase and lymphocytes at the first examination, and only an elevation in monocytes at the second examination. Exposure appeared to be related to an induction of microsomal enzymes, and this effect seemed to be subsiding after the cessation of direct exposure. ... Despite these physiological measures associated with elevated concentrations of PCB in the body, there was no evidence of health impairment in the workers. [Lawton RW et al; Environ Health Perspect 60: 165-84 (1985)] **PEER REVIEWED**

HTOX - Polychlorinated Biphenyl (PCB) concentrations in the blood of mothers who were occupationally exposed to PCBs in a capacitor manufacturing

facility, and their children, were analyzed from 1975 to 1979. The factory terminated PCB use in 1972, and environmental PCBs were eliminated artificially. Despite this, blood PCB levels of the mothers were very high, ie, 10-100 times higher than that of non-occupationally exposed persons. The PCB levels in blood of children were influenced greatly by the duration of breast-feeding, but showed little relationship to the PCB levels in maternal blood. The PCB concentration in the children's blood decreased at a constant rate and was independent of their blood PCB levels. A similar result was noted for their mothers' PCB levels. A slight difference, however, was found in the rate of decrease of blood PCB levels between the mothers and children. [Yakushiji T et al; Arch Environ Health 39 (5): 368-75 (1984)] **PEER REVIEWED**

NTOX - A DOSE-RELATED INCR IN INCIDENCE OF FOCAL LESIONS WAS OBSERVED IN THE STOMACH OF F344 RATS FED DIETS CONTAINING AROCLOR 1254 FOR 2 YR. RATS FED A DIET CONTAINING 28, 50, OR 100 PPM HAD INCIDENCES OF 10, 17, & 35% RESPECTIVELY (CONTROL GROUP 6%). MAJORITY OF GASTRIC LESIONS WERE HISTOLOGICALLY IDENTIFIED AS INTESTINAL METAPLASIA. ADENOCARCINOMAS WERE FOUND IN 6 SPECIMENS. APPROX 88% OF THE LESIONS WERE LOCATED IN PYLORIC REGION OF GLANDULAR STOMACH. [MORGAN RW ET AL; CANCER RES 41 (12, PART 1): 5052-9 (1981)] **PEER REVIEWED**

NTOX - THE AMT OF DNA FRAGMENTATION OBSERVED IN LIVER OF RATS 12 HR AFTER ADMIN OF SINGLE IP DOSE OF 500 MG/KG OF AROCLOR 1254 WAS SLIGHTLY GREATER THAN THAT INDUCED AT THE SAME TIME BY SINGLE ORAL DOSE OF 1295 MG/KG. AN EVEN HIGHER DEGREE OF DNA DAMAGE WAS PRESENT 5 DAYS AFTERWARDS, PROBABLY DUE TO PROLONGED ABSORPTION FROM PERITONEAL CAVITY. THUS, BOTH ORAL & IP TREATMENT WITH AROCLOR 1254 CAUSES DNA FRAGMENTATION IN THE LIVER, WHICH IS THE TARGET ORGAN OF CARCINOGENIC ACTIVITY OF THIS CMPD. [ROBBIANO L, PINO A; BOLL- SOC ITAL BIOL SPER 57 (4): 407-13 (1981)] **PEER REVIEWED**

NTOX - ULTRASTRUCTURAL ALTERATIONS IN THYROID FOLLICULAR CELLS OF OSBORNE-MENDEL RATS FOLLOWING AROCLOR 1254 (50 & 500 PPM) ADMIN IN DIET CONTRIBUTED IN PART TO THE DECREASE IN SERUM THYROXINE LEVELS. THYROXINE LEVELS WERE REDUCED IN RATS FED 50 & 500 PPM AROCLOR DAILY FOR 4 & 12 WK. [COLLINS WT JR ET AL; ANIM MONIT ENVIRON POLLUT (SYMP PATHOBIOL ENVIRON POLLUT: ANIM MODELS WILDL MONIT) 327-38 (1979)] **PEER REVIEWED**

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USER:

no

more animal inf available

SS 4 /C?

USER:

prt htxv

HSN - 6357

NAME - AROCLOR 1254

RN - 11097-69-1

HTXV - ND

SS 4 /C?

USER:

prt enex

HSN - 6357

NAME - AROCLOR 1254

RN - 11097-69-1

ENVS - Current evidence suggests that the major source of Aroclor 1254 release to the environment is an environmental cycling process of Aroclor 1254 previously introduced into the environment; this cycling process involves volatilization from ground surfaces (water, soil) into the atmosphere with subsequent removal from the atmosphere via wet/dry deposition and

then volatilization. PCBs, such as Aroclor 1254, are also currently released to the environment from landfills containing PCB waste materials and products, incineration of municipal refuse and sewage sludge, and improper (or illegal) disposal of PCB materials, such as waste transformer fluid, to open areas. Aroclor 1254 is a mixture of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of the PCB congeners increase with an increase in the degree of chlorination. Screening studies have shown that Aroclor 1254 is generally resistant to biodegradation. Although biodegradation of Aroclor 1254 may occur slowly in the environment, no other degradation mechanism have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil. The PCB composition of the biodegraded Aroclor is different from the original Aroclor. If released to soil, the PCB congeners present in Aroclor 1254 will become tightly adsorbed to the soil particles. In the presence of organic solvents, PCBs may have a tendency to leach through soil. Although the volatilization rate of Aroclor 1254 may be low from soil surfaces, the total loss by volatilization over time may be significant because of the persistence and stability of Aroclor 1254. Enrichment of the low Cl PCBs occurs in the vapor phase relative to the original Aroclor; the residue will be enriched in the PCBs containing high Cl content. If released to water, adsorption to sediment and suspended matter will be an important fate process. Although adsorption can immobilize Aroclor 1254 for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, Aroclor 1254 volatilizes relatively rapidly from water. However, strong PCB adsorption competes with volatilization which may have a half-life in excess of 4 years in typical bodies of water. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of Aroclor 1254. Aroclor 1254 has been shown to bioconcentrate significantly in aquatic organisms. If released to the atmosphere, the PCB congeners in Aroclor 1254 will primarily exist in the vapor-phase with enrichment of the most volatile PCBs although a relatively small percentage will partition to the particulate phase. The dominant atmospheric transformation process for these congeners is probably the vapor-phase reaction with hydroxyl radicals which has estimated half-lives ranging for 3.1 months to 1.3 years. Physical removal of Aroclor 1254 from the atmosphere, which is very important environmentally due to the chemical stability of Aroclor 1254, is accomplished by wet and dry deposition. The major Aroclor 1254 exposure routes to humans are through food and drinking water, and by inhalation of contaminated air. Dermal exposure is important for workers involved with handling PCB-containing electrical equipment, spills or waste-site materials and for swimmers in polluted water. Exposure through consumption of contaminated fish may be especially important. (SRC)

[CITATION] **PEER REVIEWED**

NATS - ND

ARTS - Current sources of PCB release to the environment include releases from landfills containing PCB waste materials and products, incineration of municipal refuse and sewage sludge, and improper (or illegal) disposal of PCB materials, such as waste transformer fluid, to open areas(1,2). Monitoring of atmospheric emissions of PCBs from landfills and incinerator stacks has indicated that emission rates from these sources are small compared to the 900,000 kg/yr of PCBs estimated to cycle through the atmosphere over the USA annually(2). Atmospheric washout and fallout have been identified as non-point sources of PCB exposure to the environment(1,3,4). Although additional research is required for a definitive answer, current evidence suggests that the major source of PCB release to the environment is an environmental cycling process of PCBs previously introduced into the environment.

volatilization from ground surfaces (water, soil) into the atmosphere with subsequent removal from the atmosphere via wet/dry deposition and then revolatilization(2,3,4, SRC). This cycling process appears to be particularly applicable to the higher chlorinated congeners, such as in Aroclor 1254, due to their environmental chemical stability(SRC). During all these cycles, the PCB composition changes in each phase relative to the original Aroclor so that specific Aroclor contributions may become impossible to assign. Specific congener PCB analysis must be performed on environmental media to obtain the total extent of PCB pollution(4). [(1) Weant GE, McCormick GS; Nonindustrial Sources of Potential Toxic Substances and Their Applicability to Source Apportionment Methods p. 36, 86 (1984) USEPA-450/4-84-003 NTIS PB 84-231232 (2) Murphy TJ et al; Environ Sci Technol 19: 342-6 (1985) (3) Swackhamer DL, Armstrong DE; Environ Sci Technol 20: 879-83 (1986) (4) Larrison P; Nature 317: 347-9 (1985) (4) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414 p. IV-30 (1987)] **PEER REVIEWED**

ARTS - High resolution gas chromatography/negative chemical ionization mass spectrometry (HRGC/NCI-MS) was employed to detect and quantify brominated compounds at high sensitivity, with minimal interference from other halogenated materials. The technique was applied to detection of brominated contaminants in technical polychlorinated-biphenyls (PCBs), brominated aromatic compounds in automotive emissions from leaded gasoline additives, and for the first identification of brominated tricyclic aromatic compounds in soot from and accidental fire. For most brominated aromatic compounds studied, the predominant reactions were dissociative electron capture and halide anion formation, making the detection of very small quantities possible. For high sensitivity, at least two bromine (Br) substituents must be present in a molecule or a single Br accompanied by additional chlorine substituents. This technique should permit detection of trace levels of these compounds in environmental and biological samples at the parts per trillion level or below. In automotive emissions, predominantly brominated compounds were detected by this technique, despite the presence of much greater quantities of aliphatic and aromatic hydrocarbons and oxygenated compounds. ... Analysis of the technical PCB, Aroclor 1254 revealed the presence of a series of brominated contaminants. [Buser H-R; Analytical Chemistry 58 (14): 2913-19 (1986)] **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

USER:

yes

FATE - TERRESTRIAL FATE: PCBs, such as Aroclor 1254, are mixtures of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination(1). In general, the persistence of PCB congeners increases with the degree of chlorination. Screening tests have shown that Aroclor 1254 is generally resistant to biodegradation. Although biodegradation of Aroclor 1254 may occur slowly in the environment basis, no other degradation mechanisms have been shown to be important in soil systems; therefore, biodegradation may be the ultimate degradation process in soil. Experimentally determined Koc values have shown that Aroclor 1254 will be tightly adsorbed in soil with adsorption generally increasing as the degree of chlorination of the individual congeners increase. Aroclor 1254 should not leach significantly in most aqueous soil systems although the most water soluble PCBs will be leached preferentially. In the presence of organic solvents, which may be possible at waste sites, PCBs may have a tendency to leach through soil. Although the volatilization rate of Aroclor 1254 may be low from soil surfaces due to the tight adsorption, the total loss by volatilization over time may be both significant and the major loss process, due to the persistence and chemical stability of Aroclor 1254. (SRC) [(1) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II 1-30 USEPA ECAO-CIN-414 (1987)] **PEER REVIEWED**

FATE - AQUATIC FATE: PCBs, such as Aroclor 1254, are mixtures of different congeners of chlorobiphenyls and the relative importance of the environmental fate mechanisms generally depends on the degree of

chlorination (1). In general, the persistence of PCBs increases with the degree of chlorination. Screening tests have shown that Aroclor 1254 is generally resistant to biodegradation. It has also been shown that the higher chlorinated congeners in PCBs are susceptible to reductive dechlorination by anaerobic microorganisms found in aquatic sediments(2). Although biodegradation of higher chlorinated congeners may occur very slowly in the environment, no other degradation mechanisms have been shown to be important in environmental aquatic systems; therefore, biodegradation may be the ultimate degradation process in natural water. In water, adsorption to sediments and organic matter is a major fate process for Aroclor 1254(1,3). The PCBs with the highest vapor pressures (low Cl) will be enriched in air. The lower chlorinated congeners of Aroclor 1254 will sorb less strongly than the higher chlorinated congeners. Although adsorption can immobilize PCBs for relatively long periods of time in the aquatic environment, resolution into the water column has been shown to occur on an environmental level suggesting that the substantial quantities of PCBs contained in aquatic sediments can act as an environmental sink for environmental redistribution of PCBs(4,5). Volatilization of dissolved Aroclor 1254 is an important aquatic process. A study conducted on Lake Michigan has indicated that volatilization may be the major removal mechanism of total PCBs from lakes(4). The most water soluble PCBs will be enriched in water relative to the sediment, and the leached sediment will be enriched in the higher chlorinated PCBs (lowest solubilities in water). Strong PCB adsorption to sediment significantly decreases the rate of volatilization; the volatilization half-life of Aroclor 1254 from typical bodies of water has been estimated to be in excess of 4 years when the effects of adsorption are considered. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of the persistence and stability of the PCBs. Aquatic hydrolysis and oxidation are not important processes with respect of Aroclor 1254. Aroclor 1254 has been shown to bioconcentrate significantly in aquatic organisms(SRC). [(1) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p. II 1-30 USEPA ECAO-CIN-414 (1987) (2) Brown JF et al; Sci 236: 709-12 (1987) (3) Callahan MA et al; Water-Related Environmental Fate of 129 Priority Pollutants Chapter 36 USEPA-400/4-79-023a (1979) (4) Swackhamer DL, Armstrong DE; Environ Sci Technol 20: 879-83 (1986) (5) Baker JE et al; Environ Sci Technol 19: 854-61 (1985)] **PEER REVIEWED**

FATE - ATMOSPHERIC FATE: The vapor pressures of the PCB congeners present in Aroclor 1254 indicate that they will exist primarily in the vapor phase in the ambient atmosphere, with enrichment of PCBs with the highest vapor pressures (low Cl) although a relatively small percentage can be expected to partition to atmospheric particulates(1,2,3). In one experiment, 2.1% of the Aroclor 1254 present in an air sample at 20 deg C was found to be associated with the particulate-phase while 25% was associated with the particulate-phase at 0 deg C(3). Physical removal of PCBs in the atmosphere is accomplished by wet and dry deposition processes(2); dry deposition will be important only for the PCB congeners associated with the particulate-phase. The detection of Aroclor 1254 in various rainwaters is an indication of the importance of wet deposition. The vapor-phase reaction of Aroclor 1254 with hydroxyl radicals, which are photochemically formed by sunlight, may be the dominant degradation process in the atmosphere. The estimated half-life for this reaction with the major PCB congeners present in Aroclor 1254 has been estimated to range from 3.1 months to 1.3 years with the half-life increasing as the degree of chlorination increases. The relatively long degradation half-lives in air indicate that physical removal is more important than chemical transformation. (SRC) [(1) Foreman WT, Bidleman TF; J Chromat 330: 203-16 (1985) (2) Eisenreich SJ et al; Environ Sci Technol 15: 30-8 (1981) (3) Bidleman TF et al; Environ Sci Technol 20: 1038-43 (1986)] **PEER REVIEWED**

BIOD - Results of a static flask screening procedure utilizing BOD dilution water, settled domestic wastewater inoculum, 5 and 10 ppm of Aroclor 1254 and 28 days of incubation found 0% biodegraded at the end of 28 days at the 5 ppm concn and 0% biodegraded at the 10 ppm concn(1). Degradation studies of Aroclor 1254 in 8 different types of soil for 112 days of

incubation found no degradation in 5 soils and 41-44% degradation in 3 soils(2). CO2 evolution 14(C)-radio labelled) of Aroclor 1254 from three soils from New Mexico over 240 days of incubation in either unamended soil or soil amended with sewage sludge ranged from 1-11% with the greatest CO2 evolution occurring in the presence of the sewage sludge(3). 208 mg of Aroclor 1254 in wastewater influent was diluted to a BOD of 200 ppm so that the Aroclor concn was 1 ppm. After 17 hr week treatment with a lab-scale biomass, 54% was recovered in effluent plus biomass and 30-39% was lost by volatilization(4). I(1) Tabak HH et al; J Water Pollut Contr Fed 53: 1503-18 (1981) (2) Hankin L, Sawhney BL; Soil Sci 137: 401-7 (1984) (3) Fairbanks BC et al; J Environ Qual 16: 18-24 (1987) (4) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) N-29 (1987)] **PEER REVIEWED**

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yes

ABIO - The estimated half-life for the vapor-phase reaction of the PCB congeners tetra-, penta-, hexa- and heptachlorobiphenyl with hydroxyl radicals in a typical atmosphere are 3.1 months, 4.7 months, 10 months and 1.3 years, respectively(1). Abiotic transformation processes such as hydrolysis and oxidation do not significantly degrade Aroclor 1254 in the aquatic environment(2,3). Although PCBs may be susceptible to photolysis, sufficient experimental data are not available to predict the relative importance of photolysis in the environment(4). I(1) USEPA; Graphical Exposure Modeling System (GEMS) computer base (1987) (2) Mabey WR et al; Aquatic Fate Process Data for Organic Priority Pollutants p.115-128 USEPA-440/4-81-014 (1981) (3) Callahan MA et al; Water-Related Environmental Fate of 129 Priority Pollutants Chapter 36 USEPA-440/4-79-023a (1979) (4) Leifer A et al; Environmental Transport and Transformation of Polychlorinated Biphenyls p.8-1 to 8-5 USEPA-560/5-83-025, NTIS PB84-142579 (1983)] **PEER REVIEWED**

BIOC - The log BCF of Aroclor 1254 in mullet was determined to be 5.66 during aquarium studies(1). Laboratory studies have determined Aroclor 1254 log BCFs of 4.42 in shrimp, 5.01 in oysters, and 4.43- 5.00 in fish(2). Log BCFs of 3.96-4.48 were measured in spot and pinfish using flowing seawater bioassays(3). Log BCF's for clams 3.0 to 4.4 and for fish 4.5 to 5.5(4). I(1) Shaw GR, Connell DW; Ecotox Environ Saf 13: 84-91 (1987) (2) Leifer A et al; Environmental Transport and Transformation of Polychlorinated Biphenyls p.5-9 USEPA-560/5-83-025, NTIS PB84-142579 (1983) (3) Hansen DJ et al; Bull Environ Contam Toxicol 6: 113-9 (1971) (4) Rice CP, White DS; Environ Toxicol Chem 6: 259-74 (1987)] **PEER REVIEWED**

BIOC - BCF Crassostrea virginica (American oyster), 85,000 soft parts, medium concn = 5.0 ug/l, 168 day. IUS Dept of Interior/Fish & Wildlife Service Contaminant Reviews; Polychlorinated Biphenyls Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review Biol Rept No (85)1.7 p.45 (1986)] **PEER REVIEWED**

BIOC - BCF Brachionus plicatilis (Rotifer) lipid = 340,000, dry tissue = 51,000, 45 day. IUS Dept of Interior/Fish & Wildlife Service Contaminant Reviews; Polychlorinated Biphenyls Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review Biol Rept No (85)1.7 p.46 (1986)] **PEER REVIEWED**

BIOC - BCF Orconectes nais (Crayfish) 5,100, whole body, medium concn = 1.2 ug/l, 21 day. IUS Dept of Interior/Fish & Wildlife Service Contaminant Reviews; Polychlorinated Biphenyls Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review Biol Rept No (85)1.7 p.42 (1986)] **PEER REVIEWED**

BIOC - BCF Gammarus pseudolimnaeus (Scud) 27,000, whole body, medium concn = 1.6 ug/l, 21 day. IUS Dept of Interior/Fish & Wildlife Service Contaminant Reviews; Polychlorinated Biphenyls Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review Biol Rept No (85)1.7 p.45 (1986)] **PEER REVIEWED**

BIOC - BCF: 45,600 (flowing), 12,150 (static) /Organism not specified/ [Kenaga EE, Goring CAI; Aquatic Toxicology p.78-115 (1980)] **PEER REVIEWED**

BIOC - BCF Daphnid 3,800; 4 days; Flowing /C15 fraction/ [Kenaga EE, Goring CAI; Aquatic Toxicology p.78-115 (1980)] **PEER REVIEWED**

BIOC - Freshwater prawns, *M. rosenbergii*, and clams, *C. fluminea*, were exposed for 48 or 50 days to 3 concn of a river sediment that contained environmental contaminants such as PCBs and metals. Prawns were exposed to the 1 st batch, sediment collected in May 5 1980, which contained higher concn of some metals and PCBs compared to sediment from Nov 1980, used with the clams. The highest concn of sediment from 5-80 was toxic to the prawns; sediment from 11-80 was not toxic to the clams. Tissue analyses of prawns for such PCBs as Aroclor 1242 [53463-21-9] and Aroclor 1254 [11097-69-1], demonstrated bioaccumulation. Max concn of 1242 in prawns was achieved by day 7 whereas 1254 continued to accumulate in prawn tissues during the initial 40 days of the exposure period. The PCB sediment bioaccumulation factors (BAF) for prawns ranged from 0.11 to 0.90 for 1242 and 0.20 for 1254, and were highest for animals exposed to 10% sediment. Exposed clams also accumulated PCBs (1242 plus 1254) from the sediment. Sediment BAFs for clams were 0.54 to 12.52 and were highest for animals exposed to 10% sediment. ... [Tatem HE; Arch Environ Contam Toxicol 15 (2): 171-83 (1986)] **PEER REVIEWED**

KOC - Soil Rf values of 0.02-0.04, which are indicative of soil immobility, were measured for Aroclor 1254 in Ottawa sand, Catlin loam, Ava silty clay loam and Catlin silt loam using both water and a landfill leachate(1). A review of experimental Koc values has reported Aroclor 1254 Koc values ranging from 110000-1330000(2). [(1) Leifer A et al; Environmental Transport and Transformation of Polychlorinated Biphenyls p4-11 USEPA-560/5-83-025, NTIS PB84-142579 (1983) (2) Sklarew DS, Girvin DC; Rev Environ Contam Toxicol 98: 1-41 (1987)] **PEER REVIEWED**

KOC - Koc = 42,500 [Kenaga EE, Goring CAI; Aquatic Toxicology p.78-115 (1980)] **PEER REVIEWED**

VWS - The Henry's Law Constants for the individual chlorobiphenyl components of Aroclors 1242, 1254, and 1260 were found to vary from 3.3×10^{-4} to 5×10^{-5} atm-cu m/mole at 20 degC with the Henry's Law Constant for each Aroclor mixture approximately 2×10^{-4} atm-cu m/mole(1). The Henry's Law Constant of Aroclor 1254 at 25 degC was found to be 2.83×10^{-4} atm-cu m/mole; reduction of Henry's Law Constant by one order of magnitude was predicted to result if the temperature was reduced by 25 deg C(2). The volatilization half-life of Aroclor 1254 from a shallow, rapidly moving river (1 m deep flowing 1 m/sec with a wind velocity of 3 m/sec) has been estimated to be 5.8 hours(3); however, this half-life neglects the effects of other important fate processes such as adsorption(SRC). Use of the USEPA EXAMS modelling system (which considers all environmental fate mechanisms) resulted in estimated volatilization half-lives of >4-11 yr from typical environmental river, pond and lake(4). [(1) Murphy TJ et al; Environ Sci Technol 21: 155-162 (1987) (2) Burkhard LP et al; Environ Sci Technol 19: 590-6 (1985) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods NY McGraw-Hill p.15-24 (1982) (4) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-26 USEPA ECAO-CIN-414 (1987)] **PEER REVIEWED**

VWS - Vapor loss of Aroclor 1254 from clay soil was negligible over a 4 week period, but vapor loss from sand varied from 10-75% over the same period with evaporation of the lower chlorinated congeners occurring at the faster rates (1). Vapor loss of Aroclor 1254 from three different soils was observed to be 40-50% over 2-4 months(2). Volatilization was observed to be the major process by which Aroclor 1254 was lost from three unamended calcareous soils from New Mexico during 240 days of monitoring; amending the soils with sewage sludge decreased the rate of volatilization(3). [(1) Haque R et al; Environ Sci Technol 8: 139-42 (1974) (2) Pal D et al; Res Rev 74: 45-58 (1980) (3) Fairbanks BC et al; J Environ Qual 16: 18-24 (1987)] **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

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ENTER 'YES' OR 'NO'

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yes

- VWS - To test whether soils differed in their ability to degrade PCBs, PCB-contaminated pond sediment was incubated in shake culture with 8 agricultural or forest soils. The rate and degree of degradation of Aroclor 1248, 1254, and 1260 present in the sediment were followed over 112 days. All soils but one degraded Aroclor 1248 at least 70% in 14 days and over 90% in 112 days. Aroclor 1254 was much slower than that of Aroclor 1248, and only approximately 40% of 1254 was degraded in 112 days. Aroclor 1260 was not degraded by any soil sample. As the growth of aerobic organisms in the shake cultures increased, degradation of Aroclor 1248 also increased in parallel. The number of organisms in the shake cultures that were able to use Aroclor 1221 as a carbon source reached a peak at 70 days, indicating a lag of growth of Aroclor-degrading organisms. [Hankin L, Sawhney BL; Soil Sci 137 (6): 401-7 (1984)] **PEER REVIEWED**
- WATC - DRINKING WATER: Aroclor 1254 levels ranging from not detectable to 36 ng/L were found in a reservoir serving Fort Edward, NY near the Hudson River(1). [(1) Brinkman M et al; Adv Identif Anal Org Pollut Water 2:1001-15 (1981)] **PEER REVIEWED**
- WATC - GROUNDWATER: Aroclor 1254 was detected in 30 of 1040 groundwater samples from NJ, with the highest detected concentration being 0.4 ppb(1). [(1) Page GW; Environ Sci Technol 15: 1475-80 (1981)] **PEER REVIEWED**
- WATC - SURFACE WATER: Aroclor 1254 was detected in 88 of 612 surface water samples from NJ, with the highest detected concentration being 127 ppb(1). An assessment of the USEPA STORET Database found Aroclor 1254 detected in 9.0% of 1186 observation stations(2). Aroclor 1254 has been positively detected in Lakes Ontario, Erie, Huron, Michigan and Superior(3). A mean Aroclor 1254 concn of 0.3 ppb was found in the Black Creek in Indiana during 1977-8(4). [(1) Page GW; Environ Sci Technol 15: 1475-80 (1981) (2) Staples CA et al; Environ Toxicol Chem 4: 131-42 (1985) (3) Great Lakes Water Quality Board; An Inventory of Chemical Substances Identified in the Great Lakes Ecosystem Vol I - Summary p78-8 (1983) Windsor Ontario, Canada (4) Dudley DR, Karr JR; Pestic Monitor J 13: 155-7 (1980)] **PEER REVIEWED**
- WATC - RAIN/SNOW: A review of Aroclor 1254 levels found in rain and snow from the United States has reported levels of 1-49 ng/L in rain and 24-76 ng/L in snow(1). Levels up to 158 ng/L (1975-78) found in Canada, USA and Europe with levels decreasing to 1986 (PCBs)(2). [(1) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) pIV-13,14 USEPA ECAO-CIN-414 (1987) (2) Mazurek MA, Simoneit BRT; CRC Crit Rev Environ Control 16: 41-5 (1986)] **PEER REVIEWED**
- WATC - In raw tap water in the Waterford, NY treatment plant, which also has the Hudson River as its source, mean PCB levels in 1976 were 0.12 ug/l (range: 0.05-0.24). /Polychlorinated Biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.IV-3 (1987) ECAO-CIN-414] **PEER REVIEWED**
- EFFL - An assessment of the USEPA STORET Database found Aroclor 1254 detected in 1.8% of 714 observation stations(1). The concentration of Aroclor 1254 found in the leachate from a hazardous waste landfill was 70 ppb(2). [(1) Staples CA et al; Environ Toxicol Chem 4: 131-42 (1985) (2) Venkataramani ES et al; CRC Crit Rev Environ Control 14: 333-76 (1984)] **PEER REVIEWED**
- SEDS - Aroclor 1254 levels of 0.56-1.95 ppm were found on the upper sediment layer in the Hudson River and NY Harbor in 1977; concentrations then generally increased somewhat with sediment core depth to various depths and then decreased(1). Sediment cores from Milwaukee Harbor (0-80 cm depth) contained PCB 1254 levels of 0.55-6.01 mg/kg(2). Analysis of surficial sediments from the Great Lakes and various associated waters found mean concentrations of 2.5-251.7 ng/g with the higher levels detected in Lake Erie(3). A mean Aroclor 1254 concn of 88.9 ug/kg was detected in the sediments collected from 102 sites in the St Clair River, Lake St Clair, and Detroit River during 1983(4). [(1) Bopp RP; Environ Sci Technol 16: 666 (1982) (2) Christensen ER, Lo CK; Environ Pollut (Ser B) 12: 217 (1986) (3) Thomas RL, Frank R; pp.245-67 in Phys. Behav. PCB'S Great Lakes; Mackay D et al eds Ann Arbor MI: Ann Arbor Sci (1981) (4) Pugsley CW et al; J Great Lakes Res 11: 275-89 (1985)] **PEER REVIEWED**

ATMC - Aroclor 1254 levels of 2.3 and 3.0 ng/cu m were found in the ambient air of Columbia, SC and Boston, MA, respectively, in 1978(1). Aroclor 1254 concentrations ranging from 11-573 pg/cu m were found in Swedish air in and around Stockholm(2). Concentrations of 0.06, 0.69, 0.40 and 0.41 ng/cu m were found at Enewetak Atoll (N. Pacific), in the North Atlantic, in the Gulf of Mexico, and at Pigeon Key, FL(3). Mean levels of 57 pg/cu m detected at Ragged Point, Barbados in 1977-8(4). Aroclor 1254 concentrations of 12, 12, and 5 pg/cu m were found in the S. Pacific atmosphere of Amer Samoa, Peru (coast), and New Zealand, respectively(5). Average Aroclor 1254 levels of 1.5, 0.45, 9.3 and 0.067 ng/cu m have been detected in the air of Columbia, SC (1977-82), Denver, CO (Jan 1980), New Bedford, MA (landfill-Jun 1980) and Stockholm, Sweden (1983-5), respectively(6). PCB levels in indoor air may be higher relative to outside air, especially where pre-1972 fluorescent lighting and video display terminals are being utilized; also in buildings equipped with transformers containing PCBs(7). Aroclor 1254 has been detected in incinerator emissions after burning municipal refuse and sewage sludge(7). I(1) Bidleman TF; Atmos Environ 15: 819 (1981) (2) Bidleman TF et al; Atmos Environ 21: 841 (1987) (3) Atlas E, Giam CS; Sci 211: 163 (1981) (4) Bidleman TF et al; J Marine Res 39: 443 (1981) (5) Giam CS, Atlas E; Amer Chem Soc 25: 5 (1985) (6) Bidleman TF et al; Environ Sci Technol 20: 1038-43 (1986) (7) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414, IV-29,30 (1987))

****PEER REVIEWED****

FOOD - The results of Aroclor 1254 analyses of ready-to-eat foods collected in markets of a number of US cities conducted by the US FDA as part of the Total Diet Studies for adults have been reported as follows for recent fiscal years (# of food composites, # with positive detections, ave concn of positives in ppm): 1978: (360,6,trace-0.05), 1977: (360,10,trace-0.05), 1976: (360,3,trace)(1,2,3). I(1) Podrebarac DS; J Assoc Off Anal Chem 67: 176-85 (1984) (2) Johnson RD et al; J Assoc Off Anal Chem 67: 154-66 (1984) (3) Johnson RD et al; Pestic Monitor J 15: 54-69 (1981)) ****PEER REVIEWED****

PLNT - Aroclor 1254 levels of < 0.1-0.74 ppm were found in pollen and propolis collected in 1985 at various NY State sites near honeybee hives(1). Purple loosestrife in Hudson River basin absorbed PCBs from contaminated soil in 1986 and emitted the lowest chlorinated PCBs (most volatile) during transportation(2). I(1) Morse RA et al; Bull Environ Contam Toxicol 38: 271-8 (1987) (2) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414, IV-28,29 (1987)) ****PEER REVIEWED****

CONTINUE PRINTING? (YES/NO)

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yes

PLNT - Plants accumulated PCB (polychlorinated biphenyl) (Aroclors) from soil amended with lake sediment contaminated with Aroclors 1248, 1254 and 1260. Uptake into different parts of vegetable plants was investigated in the field by growing beets (*Beta vulgaris*), turnips (*Brassica rapa*) and beans (*Phaseolus vulgaris*). In beets and turnips, leaves accumulated larger concentrations of PCB than the roots. In beans, leaves and pods contained higher concentrations than the stems, while only low concentrations were detected in the seeds. Bioaccumulation of Aroclors by plants was in the following order: Aroclor 1248 > 1254 > 1260. [Sawhney BL, Hankin L; Food Prot 47 (3): 232-6 (1984)] ****PEER REVIEWED****

FISH - Aroclor 1254 concentrations of 5.63-9.93, 2.10-3.66, and 0.48-1.89 mg/kg wet wt were detected in lake trout taken from Lakes Michigan, Huron and Superior during 1978-1982 monitoring(1). Aroclor 1254 concentrations ranging from 0.15-12 mg/kg (mean conc about 2.0-3.0) were detected in whole fish samples taken from USEPA Region 5 (Great Lakes) in 1979 (2). As part of the National Pesticide Monitoring Program, 315 fish were collected from 107 stations nationwide between 1980-1 and found to contain an Aroclor 1254 geometric mean concn of 0.24 ug/g (wet wt); this concn was lower than previous monitoring in 1976-7 and 1978-9 which found levels of 0.48 and 0.46 ug/g, respectively(3). Mean concn of Aroclor 1254 in chinook salmon eggs (*Oncorhynchus tshawytscha*) from Lake Michigan was

5.4 ug/g in 1982(4). [(1) DeVault DS et al; Arch Environ Contam Toxicol 15: 349 (1986) (2) Kuehl DW et al; Environ Int 9: 293-9 (1983) (3) Schmitt CJ et al; Arch Environ Toxicol 14: 225-260 (1985) (4) Geisy JP et al; J Great Lakes Res 12: 82-98 (1986)] **PEER REVIEWED**

FISH - Fish in the Hudson River have shown steadily declining PCB values. Large mouth bass (*M. salmoides*) contained up to 145 ug/g fillet in 1977 and 10.2 ug/g fillet in 1981. ... PCBs in 10 mussels (*Mytilus edulis*), each from 10 sites in Long Island Sound, CO, have also been reported. The mean maximum PCB levels ranged from 0.043-0.115 ppm as wet weight. These are below the 5 ppm limit set by FDA for PCBs in fish and shellfish. The maximum PCB residues in 547 finfish from the Chesapeake Bay and its tributaries during 1976-1980 have also been reported. The concentrations in flesh were as follows (in ppm): in 1976, not detected to 0.38; in 1977, 0.030-0.51; in 1978, 0.06- 4.84; in 1979, 0.01-1.60; and in 1980, 0.003-1.45. ... Fish from USA rivers generally contained <2 ug/g (1980-81); fish containing >2 ug/g wet weight were from the following rivers: the Hudson, Merrimack, Connecticut, Delaware, Mississippi in Minnesota, Ohio and Cape Fear (NC); Lakes containing fish with values above this level were Lakes Michigan, Huron, Erie and Ontario.

/Polychlorinated Biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.IV-19-25 (1987) ECAO-CIN-414] **PEER REVIEWED**

ANML - Aroclor 1254 levels of <0.1-2.60 ppm were found in honeybees collected in 1985 at various NY State sites(1). Aroclor 1254 was qualitatively detected in all 73 eel samples collected in the USA, New Zealand, and Italy(2). Aroclor 1254 levels of 0.036-0.308 ppm (wet wt) were found in whole carcasses of snow geese taken from northern Canada in 1977(3). Reindeer and wolf flesh from Sweden have been found to contain 18.4 and 58.9 ng/g Aroclor 1254(4). Game birds in New York State contained up to 15 ug/g PCBs in their subcutaneous fat(5). [(1) Morse RA et al; Bull Environ Contam Toxicol 38: 271-6 (1987) (2) Cozzani R, Dipietrogiacomo M; Ind Aliment 24: 454-6 (1985) (3) Longcore JR; J Wildl Manage 47: 1105-9 (1983) (4) Villeneuve JP et al; Chemosphere 14: 1651-8 (1985) (5) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414, IV-23,24 (1987)] **PEER REVIEWED**

ANML - Game birds in New York state contained up to 15 ug/g in their subcutaneous fat. /Polychlorinated Biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.IV-23,24 (1987) ECAO-CIN-414] **PEER REVIEWED**

MILK - Ten holstein cows were used to study the effects of PCB on productivity and health factors through a complete lactation, a nonlactating period, and 42 days of subsequent lactation. Residues in milk were over 30 ug/g (1.5 ug/g federal tolerance) had no apparent effect on health or productivity. [Willett LB et al; Fundam Appl Toxicol 9 (1): 60-8 (1987)] **PEER REVIEWED**

OEVC - Aroclor 1254 levels of 0.13 ppm (wet wt) were found in snow geese eggs taken from northern Canada in 1971(1). [(1) Longcore JR; J Wildl Manage 47: 1105-9 (1983)] **PEER REVIEWED**

OEVC - The relationships among serum polychlorinated biphenyls (PCBs) concentration, serum lipids concentration, and adipose tissue PCBs concentration were studied in humans. Fasting blood samples were obtained from 173 capacitor workers with direct occupational exposure to Aroclor-1254 (11097691), Aroclor-1242 (53469219), and Aroclor-1260 (11096825). Serum was analyzed for PCBs, albumin, triglycerides, and cholesterol. Serum PCBs ranged from 12 to 392 parts per billion (ppb) for Aroclor-1242 and 4 to 129 ppb for Aroclor 1254 and 1260. Serum concn of PCBs were significantly dependent on serum concn of lipids, but not of albumin. The apparent contribution of cholesterol and its esters to PCB transport was nearly equal to their contribution to the total serum neutral lipids present. [Brown JF JR, Lawton RW; Bull Envir Contam Tox 33 (3): 277-80 (1984)] **PEER REVIEWED**

RTEX - The major PCB exposure routes to humans are through food and drinking water, and by inhalation of contaminated air (1). Dermal exposure is important for workers involved with handling PCB- containing electrical equipment, spills or waste-site materials and for swimmers in polluted water(1). Exposure through consumption of contaminated fish may be

especially important. [(1) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.IV-36 USEPA ECAO-CIN-414 (1987)]
PEER REVIEWED

AVDI - AIR INTAKE: (assume 0.20 ug PCB/m cu, 16 hrs indoors) - 0.05 ug/kg/day(1). FOOD INTAKE: 0.01 ug/kg/day(1). WATER INTAKE: Predominant source of PCB exposure in the adult male when drinking water levels exceed 1.0 ug/L(1). [(1) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414 p. IV-34 1987)] **PEER REVIEWED**

PBEX - It was estimated that approximately 12,000 US workers were potentially exposed to PCBs (all Aroclors) annually from 1970-1976(1). The potential levels of PCBs, such as Aroclor 1254, in indoor air may be from 2 to 10 times higher than typical levels found in outdoor due in part to the presence of PCB-containing transformers and electrical parts(2). [(1) NIOSH; Criteria for a Recommended Standard, Occupational Exposure to Polychlorinated Biphenyls (1977) NIOSH Publ No. 77-225 (2) USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.II-29, 30 USEPA ECAO-CIN-414 (1987)] **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

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yes

BODY - Aroclor 1254 levels of 0.12-2.2 ppm (lipid basis) were detected in 54 samples of human milk collected in Hawaii in 1979-80(1). Mean Aroclor 1254 concentrations of 16 and 26 ppb were found in female and male plasma, respectively, of workers involved in capacitor manufacture(2). Mean Aroclor 1254 concentrations of 10 and 21 ppm were found in female and male adipose tissue, respectively, of workers involved in capacitor manufacture(2). EPA human monitoring program found PCB body pattern to be similar irrespective to source for non-occupationally exposed humans; PCB pattern resembled Aroclor 1260(2). The 2,3,4,5-PCBs are preferentially enriched in human milk with at least 2 rings substituted (>C14). Thus the PCB congeners from Aroclor 1016 would be major contributors (only for Aroclor 1016, 1221)(2). [(1) Takei GH et al; Bull Environ Contam Toxicol 30: 600 (1983) (2) Wolff MS et al; Int Arch Occup Environ Health 49: 199-208 (1982) (2)USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) ECAO-CIN-414 p. IV-32 to 33 (1987)]
PEER REVIEWED

BODY - EPA monitoring program found PCB body pattern to be similar irrespective of source for non-occupationally exposed humans; PCB pattern resembled Aroclor 1260. /Polychlorinated Biphenyls/ [USEPA; Drinking Water Criteria Document for Polychlorinated Biphenyls (PCBs) p.IV-32 (1987) ECAO-CIN-414] **PEER REVIEWED**

60

USER:

prt man

HSN - 6357

NAME - AROCLOR 1254

RN - 11097-69-1

SAMP - Filter + solid sorbent (13 mm fiber + Florisil, 100 mg/50 mg). /Polychlorinated biphenyls/ [NIOSH. MANUAL ANALYT METH 3RD ED VOLS 1,2 & SUPPLS 1984. V2 S503-1] **PEER REVIEWED**

SAMP - PCBs with the highest vapor pressures(fewest chlorines) in Aroclors 1016, 1242, 1254, and 1268 were enriched in the vapor phase relative to the original Aroclor during the volatilization from a glass surface for up to 8 hr. Thus, visual matching of chromatograms with those of Aroclor standards may not be sufficient to identify a specific Aroclor. [Ming Lin J, Que Hee S; Am Ind Hyg Assoc J 48 (7): 533-607 (1987)] **PEER REVIEWED**

- SAMP - The National Institute for Occupational Safety and Health currently recommends that deactivated Florisil be used as the sorbent to collect Aroclor 1254 vapor. A comparison study was conducted to determine the sampling ability of XAD-2, Tenax-GC, and Chromosorb 102 against deactivated Florisil. Results of the spiking tests, EC/GC analysis, and vapor generation tests indicate that Chromosorb 102 performed as well as deactivated Florisil except when recovering aroclor 1254 under 90 percent humidity. The vapor collection was less precise for Chromosorb 102 compared to deactivated Florisil. The results of the spiking test also indicated that XAD-2 and Tenax-GC are adequate sampling sorbents. [Brownlow CS, Que Hee SS; Amer Indust Hyg Assoc Jour 46 (8): 421-6 (1985)] **PEER REVIEWED**
- ALAB - HPLC ON REVERSED PHASE MICROPARTICLE COLUMN WAS USED TO RESOLVE COMMERCIAL MIXTURES OF POLYCHLORINATED BIPHENYLS, AROCLOR 1221, 1016 & 1254. [KAMINSKY KS, PASCO MJ; J CHROMATOGR 155 (2): 363-70 (1978)] **PEER REVIEWED**
- ALAB - ANALYTE: POLYCHLORINATED BIPHENYL (PCB); MATRIX: AIR; RANGE: 0.01-10 MG/CU M; PROCEDURE: GC. /POLYCHLORINATED BIPHENYLS/ [NIOSH MANUAL ANALY METH. VOL1-7 1977-PRESENT V1 253-11] **PEER REVIEWED**
- ALAB - Analyte: polychlorobiphenyls; range: 0.4-4 ug/sample; procedure: gas chromatography with electron capture detector; matrix: not given; precision: 0.044. /Polychlorinated biphenyls/ [NIOSH. MANUAL ANALYT METH 3RD ED VOLS 1,2 & SUPPLS 1984. V2 5503-11] **PEER REVIEWED**
- ALAB - A GC METHOD IS DESCRIBED FOR ANALYSIS OF POLYCHLORINATED BIPHENYLS. [BUSH B ET AL; J ASSOC OFF ANAL CHEM 65 (3): 55-66 (1982)] **PEER REVIEWED**
- ALAB - A principal components multivariable statistical method based on SIMCA 3B (Soft Independent Method of Class Analogy) algorithms was evaluated and applied to interpretation of homolog-specific analysis of polychlorinated biphenyls by high resolution gas chromatography. High resolution gas chromatograms can be evaluated in high resolution separations of individual PCB isomers and grouped into the homologous series. The chromatograms show distinct differences between PCB compositions with different contents of chlorine atoms in technical mixtures (Aroclors). The objective of utilizing SIMCA 3B was its evaluation for a possible identification, classification, and categorization of Aroclors in environmental samples. /Aroclors/ [Onuska FI et al; J High Resolution Chromatogr Chromatogr Commun 8 (11): 747-54 (1985)] **PEER REVIEWED**
- ALAB - PCBs with the highest vapor pressures (fewest chlorines) in Aroclors 1016, 1242, 1254 and 1268 were enriched in the vapor phase relative to the original Aroclor during volatilization from a glass surface for up to 8 hr. PCBs with the lowest vapor pressures (most highly chlorinated) were enriched in the corresponding residue. Thus, standards may not be sufficient to identify a specific Aroclor since the past history of a sample is often unknown. The enrichment also was detected using isomeric classes, but not using total chlorine content. The perchlorination method and the Webb-McCall method using all chromatographic peaks agreed quantitatively; this was not always so for the NIOSH multiple peaks and the Webb-McCall methods. [Lin JM, Que Hee S; Am Ind Hyg Assoc J 48 (7): 539-607 (1987)] **PEER REVIEWED**
- ALAB - The yield of decachlorobiphenyl (DCB) from representative Aroclors (1016, 1242, 1254, 1268) (50 to 6000 ng) using antimony pentachloride as perchlorinating agent was extremely temperature dependent below 236 deg C for a reaction period of 2 hr at 288 deg C, a 35-min reaction period was sufficient to obtain DCB yields > 80% for Aroclors 1016, 1242, 1254 and 1268. The perchlorination process was first order. The temperature dependence of the reaction times below 236 deg C was largely responsible for the inconsistent perchlorination yields reported previously in the literature. The extraction of DCB with hexane from a HCl-acidified perchlorinated solution and the subsequent column chromatography on silica gel were also essential after the perchlorination to quantitate the DCB by ⁶³Ni electron capture/gas chromatography. The structures of the 2 nonachlorobiphenyls, which were the penultimate stable intermediates before DCB, were found. The methodology to use the technique for air samples was described. [Lin JM, Que Hee S; Anal Chem 57 (11): 2130-4 (1985)] **PEER REVIEWED**
- ALAB - Methane chemical ionization (CI)-selected ion monitoring (SIM) mass

spectrometry was used to identify and conclusively distinguish 19 organochlorine pesticides from PCBs at part per trillion to ppb levels in environmental water sample experiments with minimal sample cleanup. Two CI-SIM screens were developed. One set of ions scanned specifically for the presence of 4 classes of pesticides: diphenylmethane derivatives, bridges polycyclic chlorinated hydrocarbons, chlorinated benzenes, and acetanilide pesticides. The second set of ions responded exclusively to PCBs with biphenyl moieties containing 1-8 Cl atoms. The detection limit for pesticides and PCBs by CI-SIM screening was 0.005 and 0.1 ppb, respectively. [Hargesheimer EE; J Assoc Off Anal Chem 67 (6): 1067-75 (1984)] **PEER REVIEWED**

CLAB - ANALYTE: POLYCHLORINATED BIPHENYLS; MATRIX: BLOOD 82

NG/ML; PROCEDURE: GLC WITH ELECTRON CAPTURE DETECTOR. /POLYCHLORINATED BIPHENYLS/ INIOSH MANUAL ANALY METH. VOL1-7 1977-PRESENT V6 329-11 **PEER REVIEWED**

CLAB - The yield of decachlorobiphenyl (DCB) from representative aroclors (1016, 1242, 1254, 1268) (50 to 6000 ng) using antimony pentachloride as perchlorinating agent was extremely temperature dependent below 236 deg C for a reaction period of 2 hr at 288 deg C, a 35-min reaction period was sufficient to obtain DCB yields > 80% for aroclors 1016, 1242, 1254 and 1268. The prechlorination process was first order. The temperature dependence of the reaction times below 236 deg C was largely responsible for the inconsistent perchlorination yields reported previously in the literature. The extraction of DCB with hexane from a HCl-acidified perchlorinated solution and the subsequent column chromatography on silica gel were also essential after the perchlorination to quantitate the DCB by (63)Ni electron capture/gas chromatography. The structures of the 2 nonachlorobiphenyls, which were the penultimate stable intermediates before DCB, were found. The methodology to use the technique for (human) blood samples was described. [Lin JM, Que Hee S; Anal Chem 57 (11): 2130-4 (1985)] **PEER REVIEWED**

CONTINUE PRINTING? (YES/NO)

USER:

yes

CLAB - The 95% prediction interval for single measurements of serum Aroclor reported by a reputable commercial analyst was chlorinated biphenyl levels in a population of capacitor workers who had formerly had direct exposure to the commercial PCB, Aroclors 1016, 1242 and 1254, were found to be alternatively reportable as 1905 ppb minimum initial PCB (as calculated from most persistent peaks present); 1093 ppb non-overlapping analytical Aroclor levels (as calculated by the conventional sum-of-the-peak-heights method); 303 ppb total PCB actually present; or 19 ppb human PCB (as calculated by the NHMP procedure). The broad spread in reportable values was relatable to the PCB isomer distribution and clearance patterns in the occupationally exposed population. [Lawton RW et al; Arch Environ Health 40 (1): 29-37 (1985)] **PEER REVIEWED**

CLAB - Goats sera were obtained and analyzed by gas chromatography. [Burse V W et al; Fifth National Conference on Management of Uncontrolled Hazardous Waste Sites p.243-7 (1984)] **PEER REVIEWED**

SS 4 /C7

USER:

stop y

TIME 0:55:35

NLM TIME 16:01:35

...

GOOD-BYE!

THE ESTIMATED TOTAL TOXNET COST FOR THIS 55 MINUTE TERMINAL SESSION IS \$ 32.48.

*** END OF SESSION ***

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Introducing the Air Model



The CAMEO air model is a tool for estimating the movement and dispersion of an atmospheric pollutant. Like many computer applications, it can rapidly calculate problems and present results in a graphic, "user-friendly" format. This is helpful during an emergency response or planning for such a response, but keep in mind that the air model is only a tool—a tool whose accuracy depends on your correct interpretation of the data.

Think of the air model as a pair of binoculars: you observe the scene of a spill from a distance using binoculars for a detailed view of the problem. The binoculars help you to visualize details of the spill that you could not have seen without their aid. How you decide to proceed rests on *your* judgment, not that of the binoculars.

The air model is a tool that provides insights that enhance your understanding of a spill by, for example, allowing you to imagine a toxic plume that might otherwise be invisible. Further, the air model estimates pollutant concentrations downwind from the source, taking into consideration the toxicological and physical characteristics of the spilled material. You must still rely on your own sense of the situation to make a final decision on how to proceed.

Regardless of how quick the computer model is and how graphic its messages may be, remember that it is only a tool that should not be endowed with wisdom or responsibility beyond its power.

The air model, or atmospheric dispersion model, plots the distribution of a pollutant gas or vapor resulting from a spill as a series of "Gaussian" distributions, "Gaussian" referring to the equation that describes the pollutant's path.

The Gaussian equation describes a curve that we are familiar with from school—the "normal" or "bell-shaped" curve many teachers use in grading. In air dispersion modeling, this curve shows how a contaminant will be dispersed from the source of a spill. Remember that, with these curves, there is always a higher value in the center, with lesser values on either side. Figures 1 and 2 show what a Gaussian distribution looks like to the air model.

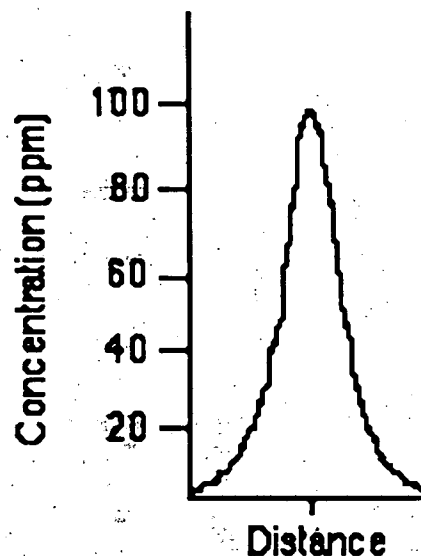
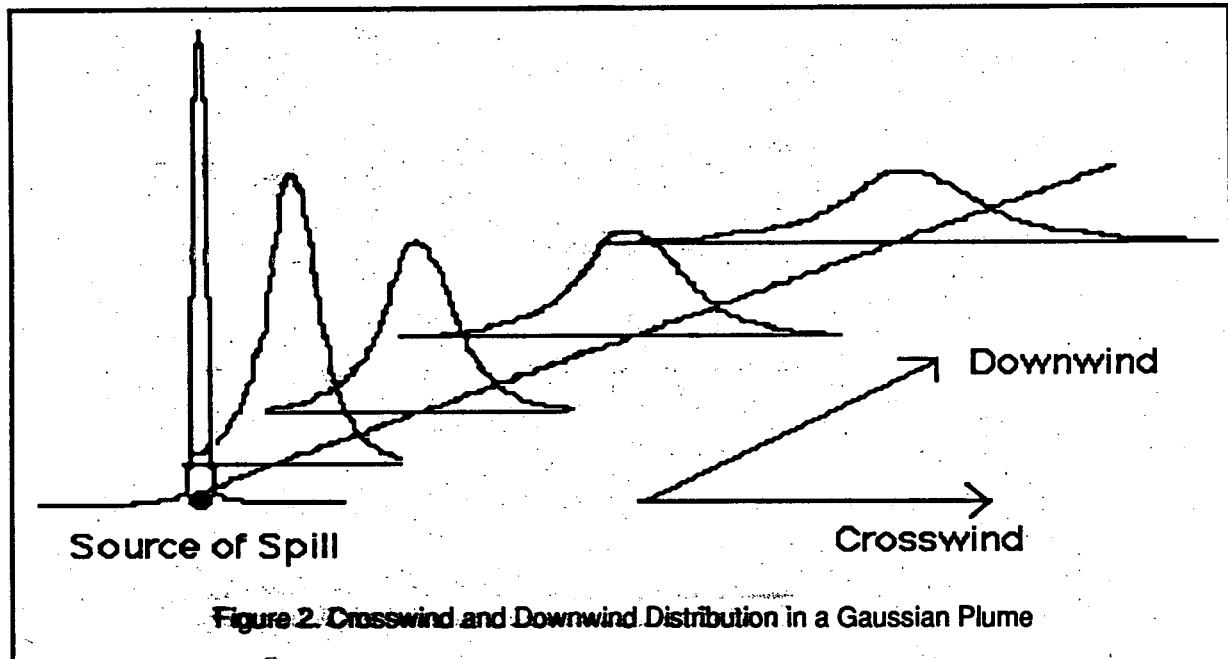


Figure 1. Gaussian Distribution of Pollutant Concentration



At the source of the spill, the concentration of the pollutant is very large and the concentration would look like a spike or a tall column. As the pollutant moves downwind, it spreads in a crosswind direction; a graph of the concentration through the plume at its source would take on a tall, narrow "bell shape." As the pollutant drifts farther downwind, the spreading continues and the "bell shape" remains but gets continually wider and flatter (Figure 2).



The air model assumes that the spill occurs at ground level, and calculates the concentration distribution on the ground. The model's visual output is a diagram that shows the top view of the plume, called the plume's "footprint." This diagram connects all the points of identical concentration on all the Gaussian curves shown in Figure 2.

The Gaussian curve you see on the screen depends on whether the spill source is continuous (ongoing) or instantaneous (released all at once).

For a continuous source, you might compare the plume to smoke from a campfire. The smoke drifts away but is continually resupplied from the source so the actual plume appears to be fixed in space (Figure 3).

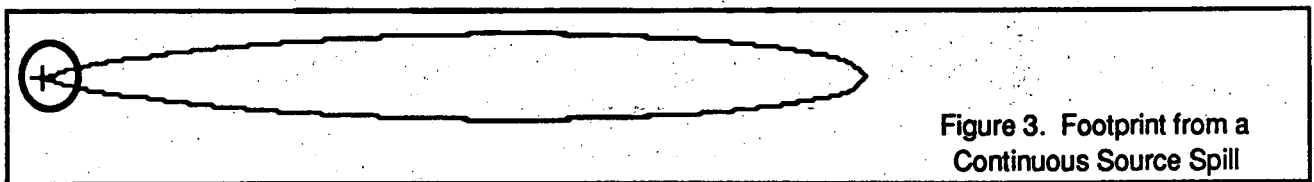


Figure 3. Footprint from a Continuous Source Spill



The circled "+" at the left of the footprint shows the source of the plume. The area inside the curve is the region that is predicted to have ground level concentrations above the limit you set during the model run. You will set the concentration in terms of a numerical value such as parts per million (ppm), or in terms of toxicological parameters such as Immediately Dangerous to Life and Health (IDLH) or Threshold Limit Value (TLV). If you have given it accurate information, the model can now calculate an appropriate evacuation zone.

In an instantaneous release, a "puff" of toxic, volatile material can be compared to a smoke signal viewed from above. Here, a puff of vapor is released from the source of the spill and drifts away as a small, detached cloud. As the wind carries it away, the puff spreads out in all directions. The plume ends when the spreading has reduced the puff's central concentration below the threshold level.

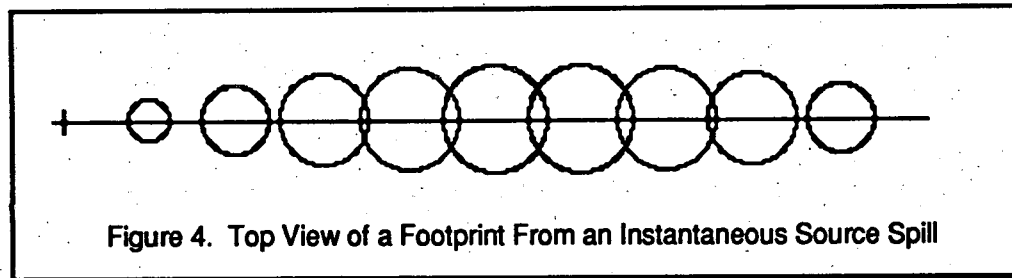


Figure 4. Top View of a Footprint From an Instantaneous Source Spill

Think of this picture as a multiple exposure of the puff as it drifts from the source to the point where its highest value is below the limit you have set. Spreading makes the puff's radius grow and then shrink as the maximum center concentration mixes down to lower values.

Once again, the "+" at the left of the footprint shows the spill source. The horizontal line is the total distance for which the puff concentrations would be above the TLV or IDLH, the value depending on which limit you set. The series of circles gives the actual "footprint" of the puff at ten different moments in time (an invisible tenth circle, at the end of the line at the far right, is the point at which the puff's radius is zero).

Questions (answers are on the next page)

1. What does "Gaussian" mean?
2. Can a Gaussian model predict isolated patches of higher concentration downwind of a source (3 ppm at 10 yards, 12 ppm at 20 yards)?
3. In Figure 4, why do the puffs get smaller towards the end of the line?



Answers

1. "Gaussian" is the shape of the model's calculation of the area downwind of the source of the chemical spill. It is a bell-shaped curve (Figures 1 and 2). Most air dispersion models are Gaussian models.
2. No. If you look at the curves in Figure 2, you can see that the concentration can only get smaller as you go downwind. A higher concentration might be explained by "patchiness" (discussed later in this manual).
3. The puffs start out small, but reach a maximum radius. Each puff represents an area where the concentration of the chemical is higher than an amount you specify (like the IDLH; see Figure 2). The farther downwind you go, the lower the peak concentration is, with the crosswind concentrations also greatly reduced.

The situation in which the debris is staged inside the vault area is such that all the combustible wood material is overlain or buried by the non-combustible material i.e. metal.

Possible fire sources:

NATURAL

1.) Spontaneous Combustion - stranger things have happened however, the materials involved and the conditions present make this possibility highly remote.

2.) Lightning - a lightning bolt strikes the roof and causes it to ignite. The roof collapses and falls upon the debris pile laying beneath. The odds of a lightning striking this building are very small. Even if such an event should occur, since the combustible material lies beneath the non-combustibles and taking into account the odds of a lightning strike, the likelihood of the wood igniting is infinitesimal.

MAN-MADE

The one question that must be asked is, Does this building possess such attraction to cause juveniles and/or mentally impaired individuals to: scale or cut through the one and in some places, two chain link fences; force their way into the building; use sledgehammers to break through the cinder block wall; manually clear thousands of tons of debris to expose the combustible fraction and then pour several hundreds gallons of gasoline on the wood in order for it to burn? I believe the answer to be NO.

In summation, the likelihood of this wood material of catching fire is almost impossible.

However, just in case the odds catch up with us, we have incorporated an air monitoring model which will determine extent of concern.

CAMEO - Computer-Aided Management of Emergency Operations

Intended for first responders, contingency planners and others who respond to chemical emergencies. The system uses a dispersion model based on the EPA's Workbook of Atmospheric Dispersion Estimates

CAMEO Air Model can help estimate downwind chemical concentrations resulting from an accident, fire, or other chemical releases. It also lets a firefighter quickly determine the extent of a plume downwind from a chemical release. This air model can also be developed for contingency planning. Using data specific to a community, contingency planning efforts can focus on relative accident simulations.

ASSUMPTIONS/VARIABLES

Atmospheric Conditions:

Stability - Unstable, the more mixing of plume therefore less of an impact. Stable, the less mixing of the plume and therefore more of an impact. We used the worse choice - Stable

Wind Speed - The higher the wind speed, the more mixing of the plume. Therefore, we chose a low wind speed of 4 miles per hour.

Ground Level Roughness - A very important factor affecting the mixing of the plume is the presence of structures, both natural and man-made, which surround the release point. We chose an average roughness since there are both very flat surfaces and numerous buildings present.

Air Temperature - Cool temperatures tend to hold the release closer to the ground surface. We decided to use an average temperature of 40 degrees F.

Source Strength:

The estimated strength of the contaminant release, PCB, was calculated to be 0.7 g/sec. This value was calculated from using an average PCB concentration of 50 ppm or 50 mg/Kg. 40% of the 2,500 cubic yards of material is considered combustible, therefore, 1,000 cubic yards of combustible material is present.

The specific gravity of oil soaked wood is 0.77 or the specific weight is $0.77 \times 62.4 \text{ \#/cf}$ or 48 \#/cf

$$1,000 \text{ cy} \times 27 \text{ cf/cy} \times 48 \text{ \#/cf} = 1,296,000 \text{ lbs}$$

$$1,296,000 \text{ lbs} \times 2.2 \text{ lbs/Kg} = 589,091 \text{ Kg}$$

$$589,091 \text{ Kg} \times 50 \text{ mg/Kg} \times 1 \text{ g/1,000 mg} = 29,500 \text{ grams}$$

$$\text{Assuming a 12 hour burn or } 12 \text{ hrs} \times 60 \text{ min/hr} \times 60 \text{ sec/min} = 43,200 \text{ sec}$$

$$\text{Loading Rate or Source Strength} = 29,500 \text{ grams} / 43,200 \text{ sec} = 0.68 \text{ g/sec}$$

The results of inputting all the above variables into the CAMEO Air Model indicated that for IDLH concentrations of PCB adsorbed to the soot particles would be present 84 feet from the source point. For the TLV concentration, the plume would extend 360 feet from the direction of wind travel.

reasonable?
or longer of
a burn?

AIR MODEL 3.4

CHEMICAL NAME : POLYCHLORINATED BIPHENYLS

TLV-TWA= .50 MG/CU. M

IDLH= 5.00 MG/CU. M

V. P.= unavailable MOL. WT.= 326.00

BOILING POINT TEMPERATURE UNAVAILABLE

WIND SPEED= 4 MPH FROM THE n

AMBIENT TEMPERATURE IS 40.0 DEG. F

NO INVERSION PRESENT / STAB. CLASS=C

GROUND ROUGHNESS IS CITY CENTER WITH HI-RISE BUILDINGS

USER INPUT SOURCE STRENGTH DIRECTLY

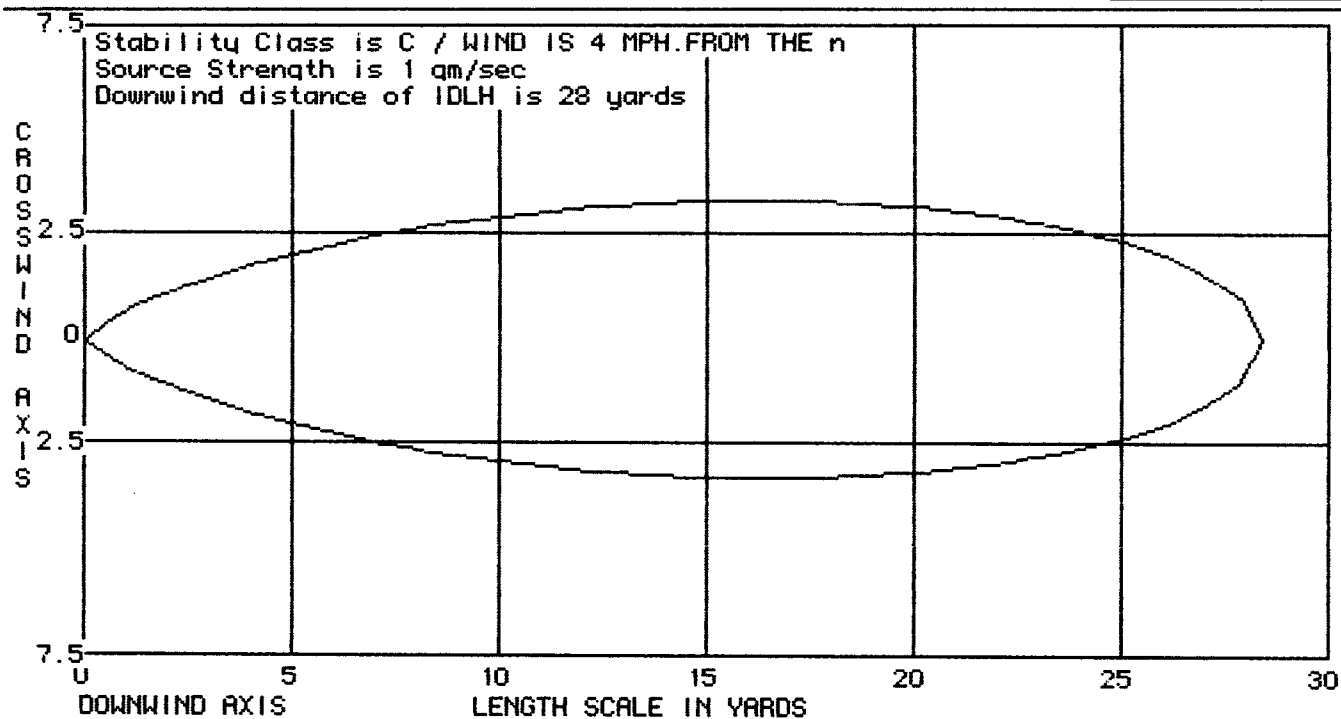
SOURCE STRENGTH IS : .7 GM/SEC

FOR A CONTINUOUS SOURCE:

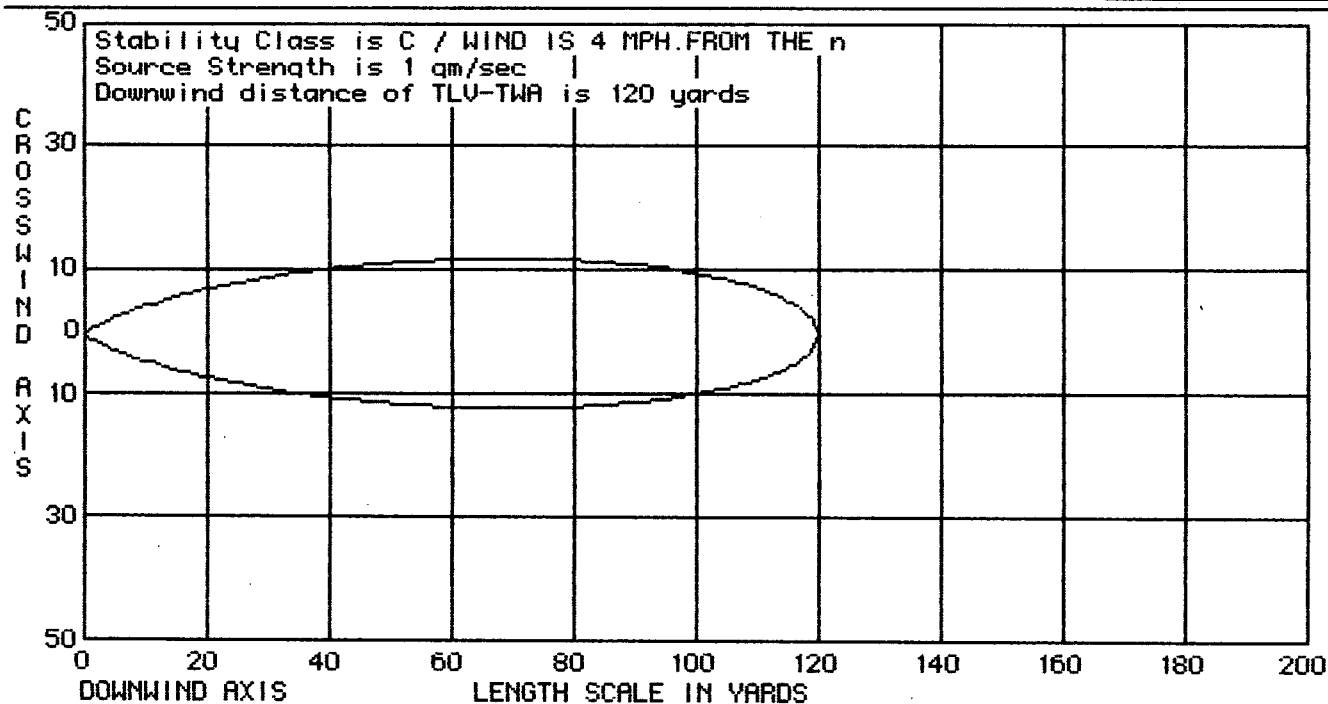
DOWNWIND IDLH DIST & TRAVEL TIME : 28 YARDS .2 MIN.

DOWNWIND TLV-TWA DIST & TRAVEL TIME : 120 YARDS & 1.0 MIN.

IDLH CONTOUR FOR POLYCHLORINATED BIPHENYLS



TWA CONTOUR FOR POLYCHLORINATED BIPHENYLS



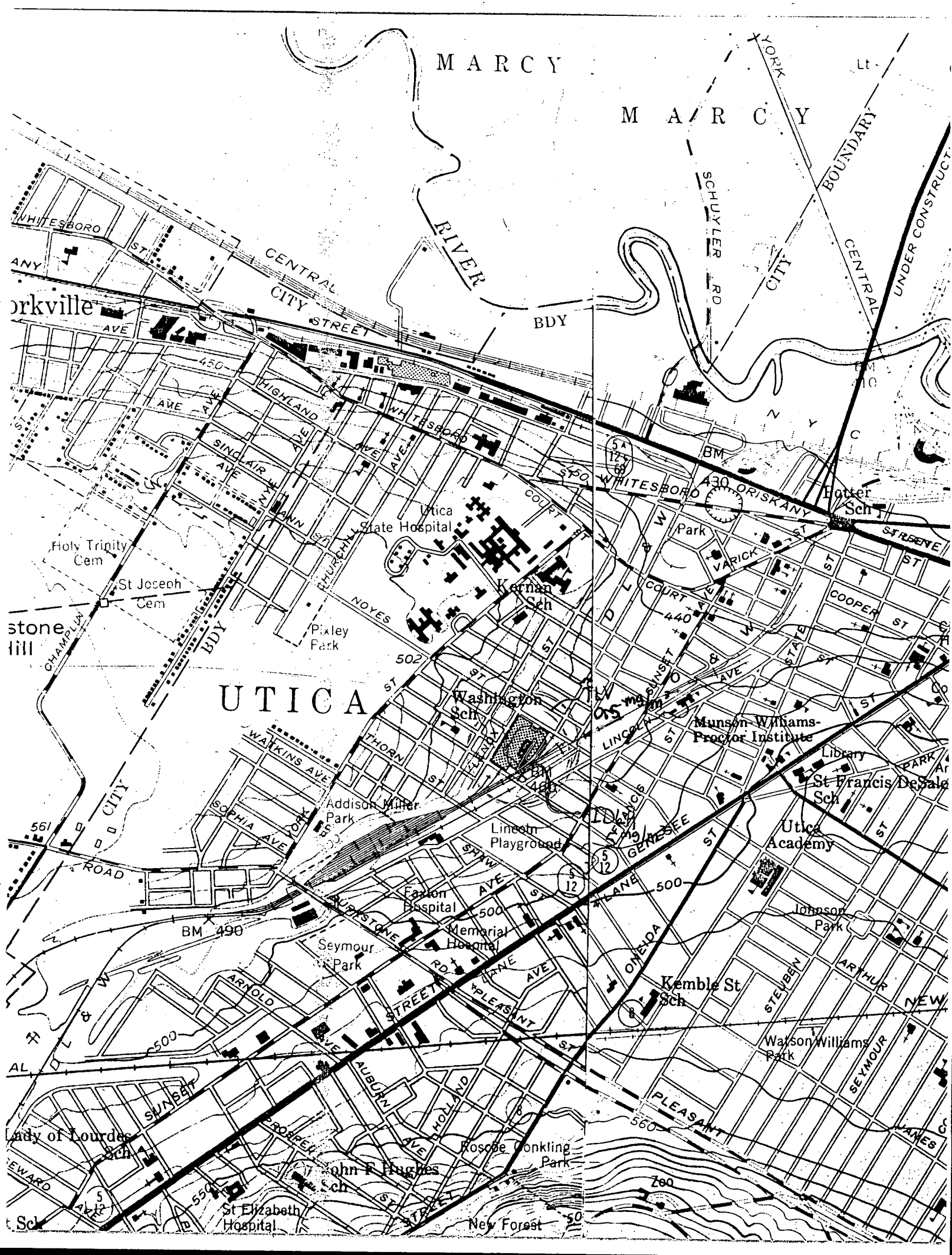


TABLE 2
PCB RESULTS FROM SAMPLE COLLECTED OFF-SITE
SWISSVALE AUTO SURPLUS PARTS
(Continued)

| <u>SAMPLE #</u> | <u>STATION</u> | <u>DESCRIPTION</u> | <u>DEPTH</u> | <u>CONCENTRATION</u> <u>PPM</u> | <u>AROCLOR 1260</u> <u>LAB REPLICATE</u> |
|-----------------|----------------|--|--------------|------------------------------------|---|
| 2552 | 12 | Sample station located in drainage trench parallel to railroad lines; east of site near Braddock Avenue overpass. Sample taken on south bank at high water mark. | 8 in. | 16 | |
| 2554 | 12 | Sample taken on north bank of high water mark. | 8 in. | 66 | 74 |
| 2556 | 12 | Sample taken in center of drainage trench. | 6 in. | 34 | 32 |
| 2558 | 18 | Sample station located in drainage trench parallel to railroad lines. Samples taken in center of trench. | 2 in. | 34 | 36 |
| 2560 | 18 | Sample taken on north bank of trench. | 1 in. | 320 | 390 |
| 2562 | 18 | Surface composite of sediment surrounding standing water at bottom of Vernon Street, on Waverly Street. | Surface | 300 | 270/280 |
| 2571 | 19 | Sample station located in vacant lot to the east of site; 35 | Surface | <1.0 | |
| 2572 | | feet east of fenceline. | 8 in. | <1.0 | |
| 2573 | | Composite and depth samples. | 16 in. | <1.0 | |
| | | | | | |

TABLE 5
DIOXIN AND DIBENZOFURAN RESULTS FROM
SAMPLES COLLECTED OFF-SITE
SWISSVALE AUTO SURPLUS PARTS

| <u>SAMPLE #</u> | <u>STATION #</u> | <u>DESCRIPTION</u> | TOTAL TCDD (ppb) <u>MEAS. (Det. Lim)</u> | 2,3,7,8 TCDD (ppb) <u>MEAS. (Det. Lim)</u> | TOTAL TCDF (ppb) <u>MEAS. (Det. Lim)</u> | 2,3,7,8 TCDF (ppb) <u>MEAS. (Det. Lim)</u> |
|-----------------|------------------|--|--|--|--|--|
| 2536 | 20 | Sample station located in hedgeline of resident on the corner of Vernon and Waverly Streets. Surface composite. | 0.05 | 0.05 | 0.14 | ND 0.28 |
| 2543 | 27 | Sample station located on south-east corner of Braddock Avenue and Vernon Street. Surface composite. | ND (0.02) | ND (0.02) | ND (0.08) | ND (0.08) |
| 2571 | 19 | Sample station located in vacant lot to the east of the site; 35 feet from eastern fenceline. Surface composite and depth. | ND (0.1) (Surface) | ND (0.1) | ND (0.12) | ND (0.12) |
| 2572 | | | ND (0.09) (8 in.) | ND (0.09) | ND (0.06) | ND (0.06) |
| 2573 | | | ND (0.03) (12 in.) | ND (0.03) | ND (0.03) | ND (0.04) |
| 2575 | N/A | Field blank | ND (0.01) | ND (0.01) | ND (0.01) | ND (0.01) |
| 2576 | N/A | Field duplicate of sample #2502 | ND (0.73) | ND (0.73) | ND (2.8) | ND (2.8) |

Table 5. Swissvale Total Dioxin and Furan Results for Dustbuster Filters and Wipes

| Congener | 2518 ^a | 2520 ^a | 2522 ^a | 2524 ^a | <i>SOOT</i> | | | | Blank ^b Dustbuster | 044A ^b TBlank | 044B ^b TBlank | TSpike 044 ^b |
|--------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|----------------------------------|-----------------------------|-----------------------------|-------------------------|
| | | | | | 2517 ^b | 2519 ^b | 2521 ^b | 2523 ^b | | | | |
| ³⁷ Cl (% Acc) | 117% | 109% | 115% | 113% | 111% | 113% | 109% | 135% | 117% | 114% | 113% | 118% |
| TCDD | 2.9 | ND(0.97) | ND(0.99) | ND(0.43) | 22 | 59 | 47 | 17 | ND(0.08) | ND(0.05) | ND(0.03) | 0.88 |
| 2, 3, 7, 8 - TCDD | ND(0.63) | ND(0.97) | ND(0.99) | ND(0.43) | 0.94 | 2.5 | 1.9 | 0.79 | ND(0.08) | ND(0.05) | ND(0.03) | 0.88 |
| TCDF | 177 | 59 | 98 | 31 | 413 | 1232 | 907 | 418 | ND(0.44) | ND(0.02) | ND(0.04) | ND(0.03) |
| 2, 3, 7, 8 - TCDF | 17 | 6.5 | 11.3 | 3.3 | 74 | 241 | 175 | 86 | ND(0.44) | ND(0.02) | ND(0.04) | ND(0.03) |
| PCDD | ND(3.3) | ND(2.2) | ND(0.78) | ND(0.07) | 61 | 142 | 128 | 38 | ND(0.10) | ND(0.09) | ND(0.20) | ND(0.07) |
| PCDF | 235 | 79 | 75 | 27 | 400 | 919 | 706 | 232 | ND(0.31) | ND(0.07) | ND(0.20) | ND(0.03) |
| Hexa CDD | 81 | 6.4 | 5.3 | ND(2.4) | 78 | 158 | 143 | 40 | ND(0.23) | ND(0.30) | ND(0.38) | ND(0.23) |
| Hexa CDF | 263 | 77 | 45 | 12 | 194 | 250 | 297 | 67 | ND(0.53) | ND(0.09) | ND(0.25) | ND(0.07) |
| Hepta CDD | 75 | ND(3.0) | 1.5 | ND(0.88) | 97 | 172 | 207 | 57 | ND(0.33) | ND(0.17) | ND(0.46) | ND(0.19) |
| Hepta CDF | 172 | 25 | 18 | 3.9 | 112 | 92 | 145 | 31 | ND(0.64) | ND(0.21) | ND(0.16) | ND(0.14) |
| OCDD | 44 | ND(0.9) | ND(2.0) | ND(2.8) | 53 | 90 | 146 | 48 | ND(0.86) | ND(0.29) | ND(0.65) | ND(0.59) |
| OCDF | 20 | ND(1.5) | 2.0 | ND(1.2) | 51 | 46 | 67 | 21 | ND(0.65) | ND(0.17) | ND(0.11) | ND(0.09) |

^aReported in ng/wipe
^bReported in ppb(ng/g)

Note: ND = Not detected - detection limits in parentheses